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Some Notes on Street Lighting.

[Prepared for the JOURNAL by MR. F. V. WESTERMAIER.]

The double-inverted mantle fixture, recently brought out by the Welsbach Street Lighting Company, is now used extensively in these cities: Chicago, Ills.; Milwaukee, Wis.; San Francisco, Cal.; Oakland, Cal.; and Portland, Me. In the two first named cities the installations are principally of the "White Way" nature, and are installed and maintained by the Company under contract with the various Merchants' Associations. In Oakland the new type of unit has been accepted as the standard street lighting unit, and in very short time 2,500 of these lamps will have been placed in service there. Other installations have been made in New York and Buffalo, N. Y., in which cities the lamps have been in use some time, with a view towards stimulating interest in a higher candle power gas street lighting unit than that offered by or through the regular, single, upright mantle type.

Open flame gas street lamps have disappeared practically in all cities of importance, save in Philadelphia and Chicago, and mantle gas street lighting is steadily increasing in this country, as can readily be seen and appreciated by a study of the following list of 21 cities throughout the United States. The percentage increase given is for the time between November, 1910, and November, 1911:

1. See A. G. L. J., May 22, 1911, P. 991.

Fig. 1.—High Pressure Keith Lamps on "Whitehall," London.

Fig. 3.—Standard Berlin Type of Street Unit Upright Mantles, 2 in each Lantern.

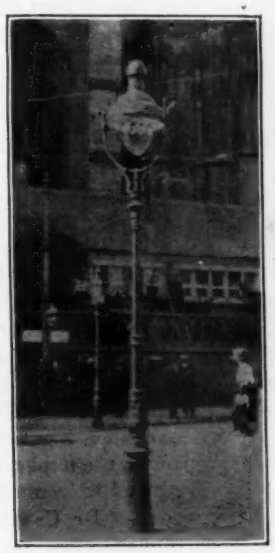


Fig. 2.—High Pressure Gas Lamp. Cologne-Graetzin Type.

Fig. 4.—Inverted Low Pressure Lamp in Westminster, London.

City.	Per Cent.
Atlantic City, N. J.	12.10
Brookline, Mass.	7.20
Buffalo, N. Y.	7.00
Cambridge, Mass.	4.10
East Orange, N. J.	4.50
Indianapolis, Ind.	3.30
Lima, O.	3.80
Lowell, Mass.	2.40
Mount Vernon, N. Y.	30.00
Milwaukee, Wis.	2.60
New Bedford, Mass.	4.30
New Rochelle, N. Y.	3.00
New York City ...	2.50
Portland, Me.	8.40
Providence, R. I.	1.50
San Francisco, Cal.	36.70
St. Louis, Mo.	3.40
Springfield, O.	6.80
Wilkes-Barre, Pa.	5.30
Williamsport, Pa.	3.30
Yonkers, N. Y.	10.10

In addition to these, practically new installations have been made in Newark and Montclair, N. J., and in Oakland, Cal. This presen-

tation is positive evidence that gas for street lighting purposes is not losing ground.

Referring to the progress of street lighting abroad, the number of miles of streets in Berlin lighted by various street illumination units are as follows:

Type of Lamp.	No. Miles.
Upright incandescent mantles, gas . .	265.00
Low pressure gas, inverted	8.25
High pressure incandescent, gas.....	31.25
Electric lighting, all sorts.....	17.50

There is shown each year a steady increase in the number of streets lighted by the high pressure gas system. The several types of lighting equipment show: Fig. 1, the high pressure Keith lamps (16 feet above sidewalk), on Whitehall, London; Fig. 2, another type of high pressure gas lamp on a much lower (13 feet 6 inches) standard, near the Cathedral, Cologne, Germany; Fig. 3, the standard type of double-mantle (upright) gas unit (12 feet 6 inches), used in Berlin, Germany; and, Fig. 4, the double, inverted, low pressure London street lamp, 12 feet in height. The types used in Brussells and Munich are similar to those shown in the London type, Fig. 4. The adoption of this latter style of inverted mantle lamp by these named European cities seems to be along similar lines to those of the Welsbach Company's double inverted mantle adopted for the boulevard type of lantern.

[Continued from Page 39.]

PROCEEDINGS, SIXTH ANNUAL MEETING, AMERICAN GAS INSTITUTE.

Held in St. Louis, Mo., October 18 to 20, 1911.

First Day—Afternoon Session.—Part I.

The President in convening the session at 2:30 P.M., announced that, to facilitate the proceedings, the meeting would be conducted in two Parts. He then introduced (to the attention of Part I.), Mr. L. E. Worthing (Chief Chemist, Detroit City Gas Company), who read the following paper on

SOME PRINCIPLES OF CONDENSATION WITH ESPECIAL REFERENCE TO WATER GAS.

Any attempt to gather from the technical journals data with reference to condensation, impresses one at once with the extreme paucity of information concerning water gas condensation, and the comparative abundance of literature (for it can scarcely be called data, for very good reasons) on the condensation of coal gas. We cannot fail to be equally impressed with the widely conflicting theories of condensation there set forth, even where the practice is substantially the same. Although, generally speaking, the advocates of slow condensation have had the upper hand recent years, yet we are left in doubt as to whether it is most desirable to effect a uniform, slow condensation, or a condensation rapid in parts and slow in other parts. Shall we carry the tar fog some distance along the condensing system, thereby bringing it to an equilibrium of tension with the naphthaline in the gas, and sacrificing the candle power, or shall we remove the tar fog at once, mechanically, by a P. & A., or one of Dr. Coleman's cyclone separators?[1] Shall we, with Mr. Barthold,[2] expose our gas in the hydraulic main to the solvent action of the tar, or shall we, with some German engineers, actually spray our gas with tar at the outlet of the hydraulic main? Shall we go still further with Prof. White, University of Michigan, who, in a paper which will have been made public before this is read, has given us the results of a series of experiments in the course of which gas was actually washed with tar of various consistencies and at different temperatures, or shall we abandon slow condensation altogether, with M. St. Clair Deville,[3] who has given up the attempt to retain the benzol which will dissolve in the tar if the latter is allowed to come to an equilibrium of tension with regard to the benzol in the gas, in order to rid himself of the naphthaline which will also be dissolved in the tar, under those circumstances?

M. St. Clair Deville has undertaken a series of tests in the experimental plant of the Paris Gas Company at La Villette. He regards it as axiomatic that the primary object of condensation is to get rid of naphthaline. As abstracted in M. Laurain's paper, read before the last meeting of the Société Technique du Gaz, his method is simply to pass the gas and tar fog upwards through a refrigerating chamber, or tubular condenser, through which the water flows in the same direction as the gas. This condenser is so adjusted in area, velocity of gas, rate of flow of water, etc., that the gas and tar fog are chilled from 150° F. to 60° F. It is, moreover, fitted with baffle-plates in the lower third of the vessel, so as to further retard the fall of the tar and bring it into more complete equilibrium with the gas. The flow of the water is so regulated that the outlet temperature is only 8° or 9° F. above that of the inlet, and the short foul main slopes down to the inlet of the condenser, so that any tar condensed there cools in contact with the gas. After leaving the refrigerator, the tar fog is removed by an impact condenser. M. Deville regards cold tar as a better absorbent of naphthaline than hot tar, and by this method utilizes the whole of the tar in the gas to absorb the naphthaline, and that in the best possible state for the rapid attainment of equilibrium with the gas; viz., in the state of tar fog. He admits the loss of a certain amount of benzol, but claims it to be only 5 per cent. of the total, and negligible in view of the other benefits obtained.

Although this system is at present in successful operation at the works at Le Londy, representing a production of 12,750,000 cubic feet per 24 hours, yet there was no lack of dissenting voices among the members of the Society. Among these was M. Grebel, who quoted a loss of benzol from 3 to 6 times as great, at the works at Gennevilliers, after the discontinuance of the hot condensers. All these systems of coal gas condensation are conditioned by the necessity for the removal of naphthaline. Water gas condensation, however, faces no such limitations.

Thrusting aside the naphthaline question, the object of condensation is to retain in the gas the desirable elements while ridding it of the undesirable. We desire to retain a maximum candle power and heating value; in other words, the greatest possible quantity of benzol and other light oil vapors, at the same time freeing it from tar fog and heavy oils. The process of condensation is governed by the laws of vapor tension, Dalton's and Regnault's laws. The application of these laws to modern gas engineering practice was very clearly demonstrated by Mr. Earnshaw, in a paper written for the third annual meeting of this Institute, on the subject of "Benzol Enrichment."

As far as one aspect of condensation is concerned, that of retaining in the gas the maximum amount of benzol vapors originally present, the principles enunciated in Mr. Earnshaw's paper are precisely the principles by which we must be guided. Water gas leaves the superheater at a temperature of from 1,200° to 1,450° F. As this is cooled, those components of lowest vapor tension will condense out of the gas, leaving the gas more or less saturated with those components (benzol, etc.) of higher vapor tension. But these high tension vapors or liquids are miscible in all proportions with the liquids (tars and heavy oils) already condensed, having low vapor tensions. Consequently, Regnault's second law—*i. e.*, when two liquids are miscible in all proportions, the vapor tension of the mixed liquid is intermediate between the tensions of the separate liquids—comes into operation.

Now, if the operation of this law is allowed to continue till the system (gas, benzol, etc.—condensate) is in equilibrium, the effect will be that some of the high tension vapors (benzol, etc.) will be absorbed by the liquids of low vapor tensions (condensate) and the average vapor tensions of the gas and condensate, with respect to benzol, will be the same. Consequently the candle power of the gas will be appreciably diminished. If the system comes to partial equilibrium, the condensate—or liquids of low vapor tension—will absorb some of the benzol, etc., having high vapor tensions. The amount of benzol, etc., absorbed, and hence the decrease in candle power, will depend altogether on the degree of equilibrium which the system (gas, benzol, condensate) has attained.

This degree of equilibrium depends on three factors:

(1.) Time of contact of condensate and gas.
(2.) State of division of condensate.
(3.) Temperature of gas and condensate.

Over the second of these factors we have little control. Concerning the first, it is obvious that the longer the time of contact between the gas and condensate, the greater the opportunity for them to come into equilibrium of tension with respect to benzol.

Concerning the third, it is equally obvious that the lower the temperature which the system (gas—benzol—condensate) is allowed to attain, the higher will be the percentage of benzol absorbed by the condensate from the gas. In other words, in order to rid ourselves of the tar and heavy oils, we are taking from the gas some of those valuable constituents which we wish to retain.

1. *Gas World*, June 11, 1904. 2. American Gas Light Journal, June 1, 1907.
3. *Journal of Gas Lighting*, May 30, 1911.

It is necessary to cool the gas in the condensing system to the lowest temperature it will meet in the mains, otherwise we are simply increasing the length of our condensing line and will get condensate out of the drips. When the gas is cooled to this necessary temperature, the condensate contained in it is in the best possible condition to absorb benzol, because, being in a state of extremely fine division, it offers a large absorbing surface, and can thus come rapidly to a condition of equilibrium with the gas. This tar fog is only slowly removed from the gas by friction along the sides of the mains, in the relief holder, in the tubular condensers, and, finally, by the P. & A.

Obviously, then, by any system which admits of a state of equilibrium of tension between the gas and condensate, we are losing a part of the valuable high tension vapors; and it is equally obvious that any form of slow condensation presents a very favorable condition for such an equilibrium, both on account of the comparatively long time contact between the gas and condensate, and the extremely fine state of division of the condensate, in the form of tar fog. A logical system of condensation would be one that afforded as short a time of contact as possible between the gas and condensate; or, rather, the complete removal of that condensate as soon as formed.

As the gas begins to cool rapidly on leaving the superheater, and as we can reasonably assume that the tar fog when first formed is in the state of extremely minute particles, thus offering a maximum absorbing surface, and as its specific capacity for absorbing benzol becomes progressively greater as the temperature is lowered, it will be advisable to install the condensing system as close as possible to the machines. It is certain that mere cooling will not rapidly remove the condensate from contact with the gas. Some mechanical method must be adopted. The impact separator has not been successful unless the whole system of gas and condensate has been reduced to a temperature where the absorptive capacity of the condensate for benzol is very great, thus resulting in a serious loss of candle power. A system which satisfies to a very considerable extent the conditions imposed on us by a consideration of the laws of vapor tension is that offered by the Doherty washer-cooler apparatus.

Briefly, this is a device in which an ascending current of gas, traveling at a relatively low velocity, meets a descending current of water sprayed into the chamber by any suitable means. The waterspray serves at once to reduce the temperature of the gas in the most efficient manner, and to wash out and carry away mechanically the resulting products of condensation. By this means the condensate produced by a given lowering of temperature is carried away at once, before it has had time to come into equilibrium of tension with the gas. This system affords the further advantage of a fractional condensation, as condensate falling from the top falls through progressively hotter and hotter temperature zones, thus decreasing its capacity for absorbing benzol and forcing it to give up any benzol absorbed, more than that normally absorbed, at the inlet temperature of the gas. It is a question, however, and one extremely difficult to determine, as to whether the condensate in the apparatus ever absorbs enough benzol to be in equilibrium of tension with the gas, even at the inlet temperature.

The solution of this question, like that of many others attendant on condensation, is conditioned by the difficulty of getting a fair sample of unpurified gas, and this difficulty makes all conclusions drawn from experimental data extremely hazardous and uncertain. Most of the data, therefore, concerning the installation that I am about to describe is taken from actual works' test, and the experimental observations, though conducted with every possible precaution, are offered for exactly what they are worth. The washer-cooler we are about to describe was installed at one of the plants of the Detroit City Gas Company, August, 1910. An old condenser shell, which had formerly been used for coal gas, was utilized for the apparatus. The shell was 33 feet long, 14 feet 10 inches high, and 5 feet 2 inches deep. It was divided into 3 washing compartments by suitable baffle-plates so arranged that the gas passed always up against a descending waterspray (see sketch).

These compartments have been numbered 1, 2 and 3 on the sketch and in the data, the first compartment being next to the outlet gas, numbering having reference to the circulation of the water, instead of that of gas. Each compartment was filled with 20 courses of wooden grids, composed of ½-inch by 6-inch strips, set edgewise, separated by ½ inch spaces. The strips in each course of grids were set at right angles to those in the courses above and below, so as to provide the most effective washing arrangement. The courses of grids were supported on 2 sets of 3 I-beams strung across each compartment. The circulating water entered a 4-inch header running above the shell with cocks for each compartment. Three 2-inch pipes across the top of the shell distributed the water into 18 sprays centered 16 inches by 18 inches. These sprays consisted of inch nipples passing 6 inches below the top of the shell, ending on a slotted cap, the slot being ¼ inch wide and about 1 inch long, looking down at a 45° angle. These caps were so arranged that the spray covered the whole surface of the grids. There was a 15-inch space between the caps and the upper course of grids.

The liquor circulation, beginning at the well, was as follows: Suction line from the well to No. 1 pump, which forced the liquor through a cooler, consisting of 2 stacks of twenty 2½-inch pipes, connected by cast iron return bends, each stack being made up of 20-foot lengths. The cooling water was supplied by the works' pump, and was distributed over the pipes by wooden troughs carefully levelled so that a stream of water of uniform thickness overflowed from one side of each trough. (See sketch.)

The liquor passed from the cooling coil into the sprays of the first section, down the grids to the base, from there through a suction line to No. 2 pump, which forced it into the sprays of the second section, thence to No. 3 pump and third section, and from there overflowed through an 8-inch sealed overflow into a 10-inch line to the well. (See sketch.) The well served as a liquor reservoir and separator basin for the tar, which was pumped daily into a small well alongside, from which it flowed by gravity to storage.

The pumps, which were of the Roots' rotary type, were geared to a 5-horse power 3-phase Allis-Chalmers motor. Actual working tests showed each pump to deliver 125 gallons per minute. They were so connected that Nos. 1 and 2 or Nos. 2 and 3 were interchangeable. One, 2 or 3 pumps and 1, 2 or 3 sections of the washer cooler could be used at will. For further details, see drawing.

The washer-cooler has been in operation for more than a year and has given most satisfactory results. The capacity is exceedingly great, and in fact can hardly be estimated—being limited only by the amount of heat to be extracted from the maximum quantity of water we can put through the washer-cooler without raising the back pressure excessively, and the ability of the cooling coils to reduce that water to a normal initial temperature. It has taken care of a make of over 300,000 feet per hour without difficulty, so long as we could obtain sufficiently cold water for the cooling coils. The water required is only 1/13 of that necessary for the old form of tubular condenser, thus relieving the works' pump of a very considerable load. The ground space, assuming it to replace scrubbers for 4 machines, is only ¼ of that necessary for the scrubbers.

As soon as the washer cooler was put into operation, we were enabled to by-pass the P. & A. and the Chollar washer. The P. & A. has not been in use since, and the Chollar washer only during heavy loads in hot weather, when the capacity of the cooling coils was not sufficient to reduce the water to the necessary initial temperature. A second cooling coil is now being installed, and will be amply sufficient to take care of any condition likely to arise in the works. The elimination of the P. & A. and Chollar washer brought to light another advantage of the washer-cooler—the exceedingly low differential through it. In the table of differential pressures through the washer-cooler for different arrangement of pumps and sections, it will be noticed that the maximum differential pressure is 1.6 inches.

Comparing that with the ordinary 15-inch differential through the P. & A. and Chollar washer, we can calculate a saving of 7-horse power per hour; and balancing against this the 2-horse power per hour, necessary to operate the circulating pumps, we have a net saving of 5-horse power per hour. The tar and heavy oils are totally removed at considerably higher temperatures than in ordinary operation. This results in more effective purification, ease of revivification and longer life of material. The percentage of oil and tar present in the purifying material is less than ½, the percentage present under the old method of operation. The material comes out of the boxes loose, instead of in sticky cakes, and revivifies with most remarkable rapidity and thoroughness.

Differential Pressures Through Washer-Cooler with 1, 2 *and* 3 *Stages and* 1, 2 *and* 3 *Pumps, Gas Passing at the Rate of* 150,000 *Cubic Feet per Hour.*

Inlet.	Outlet.	Differential.	Pumps.	Stages.
3.2	1.8	1.4	Nos. 1 and 3	2 and 3
3.2	1.8	1.4	"	"
2.4	0.9	1.5	"	"
2.6	1.2	1.4	"	"
2.6	1.2	1.4	"	"
3.1	1.8	1.3	"	1, 2 and 3
3.0	1.6	1.4	"	"

Inlet.	Outlet.	Differential.	Pumps.	Stages.
3.0	1.6	1.4	Nos. 1 and 3	1, 2 and 3
2.5	1.0	1.5	Nos. 1, 2 and 3	"
2.6	1.1	1.5	"	"
2.7	1.2	1.6	"	"
3.0	1.6	1.4	No. 1	"
2.7	1.3	1.4	"	"
2.6	1.1	1.5	"	2 and 3
2.6	1.2	1.4	"	"
2.3	0.8	1 5	"	3 (one stage)
2.2	0.6	1.6	"	"
2.2	0.6	1.6	"	"

That this system of condensation does not tend to produce a tender gas has been thoroughly demonstrated by actual operation records since it was installed, under very severe weather conditions. A test of this point was made last winter. A rather high candle power water gas was made at Station A and pumped into an inclosed holder, the holder having been flushed previous to filling. After standing in the holder 24 hours the gas was pumped through a main (over 3 miles long) to an open holder—lines and holder being also flushed—and allowed to stand for 72 hours, after which it was pumped back to Station A. Candle power and B.T.U. tests were made at 20-minute intervals, or nearly as possible, when the gas was pumped into the inclosed holder at Station A, and similar tests were made when it was pumped back to Station A from the open holder at Chene street. The gas in the holders was subjected to a minimum temperature of 12° F. and an average temperature of 26° F. A record of the tests is found in the appended table:

Water Gas Candle Power and B.T.U. from 12 : 50 A.M. *to* 4 : 25 A.M. 2-18-11, *and from* 12 : 30 A.M. *to* 3 A.M.

Gas as Made.			Gas After 96 Hours' Exposure.		
Time.	C.P.	B.T.U.	Time.	C.P.	B.T.U.
12 : 50	23.73	683.7	12 : 30	22.27	664.2
1 : 25	23.83	684.4	12 : 50	22.43	671.5
1 : 25	23.75	595.3	1 : 10	22.57	672.2
1 : 45	23.99	684.4	1 : 30	22.55	671.5
2 : 05	23.51	683.2	1 : 50	22.50	663.6
2 : 25	23.78	682.3	2 : 10	22.40	671.5
2 : 45	23.99	682.3	2 : 30	22.42	670.4
3 : 05	23.76	673.5	2 : 50	22.47	671.5
3 : 25	23.33	675.9	....	....	....
3 : 45	23.40	670.0	....	....	....
4 : 05	23.12	666.6	....	....	....
4 : 25	22.88	....	....	....	....
Average...	23.60	680.1		22.45	670.9

Loss in candle power, 1.15; loss in B.T.U.'s, 9.20

Atmospheric Temperatures to which Gas was Exposed During 96 Hours.

Date.	Minimum.	Maximum.	Average.
2-18-11.....	26	37	33
2-19-11.....	26	30	28
2-20-11.....	20	24	22
2-21-11.....	12	22	17
2-22-11.....	28	34	30

These results show that this gas which, under ordinary condensing conditions, could not fail to be extremely tender, showed a drop of 1.15 candles and 9.2 B.T.U.'s, which speaks for itself. A determination of the amount of benzol absorbed by the condensate in the washer cooler is attended by considerable difficulties, owing to the extremely uncertain samples of unpurified gas obtained. In arriving at the results in the appended table, large sample tubes were inserted in the main at the inlet and outlet of the washer-cooler, these tubes being capped and having openings looking in the same direction as the stream of gas. These openings were, respectively, in the center, midway between the center and circumference, and at the periphery of the main. The sample tubes were bushed down to ¼ inch in the main and the gas stream was led through trains of flasks, set in a freezing mixture, thence through a tar filter of glass wool, to the meter. As the apparatus was on the inlet side of the exhauster, the gas stream was pulled through the train with an air aspirator. All connections were ¼-inch glass tubing, and every precaution was taken to prevent tar washing of the gas. Condensate from these tests was taken, separated from the water, carefully fractionated, and the amount and specific gravity of the benzol determined. The results are given below, and show a comparatively slight loss of benzol (hence, of candle power) in the washer-cooler.

Grams of Benzol per Cubic Feet of Gas at Inlet and Outlet of Washer-Cooler. Benzol Fraction to 81° C. Redistilled.

	No.	Cubic Feet of Gas.	Inlet Temperature.	Outlet Temperature.	Gram. Benzol per Cubic Foot.	Sp. Gr. Gas at 15° C.
A.	Inlet.....	220	160	49	0.149	0.874
	Outlet.....	264	120	47	0.137	0.880
B.	Inlet.....	324	154	48	0.143	0.876
	Outlet.....	280	126	48	0.136	0.878
C.	Inlet	262	165	51	0.153	0.872
	Outlet.....	196	132	50	0.156	0.874
D.	Inlet.....	149	144	47	0.162	0.875
	Outlet	184	115	48	0.144	0.883
E.	Inlet.....	265	154	50	0.151	0.875
	Outlet.....	200	123	48	0.142	0.882
F.	Inlet.....	125	142	48	0.147	0.872
	Outlet.....	160	118	49	0 140	0.876
G.	Inlet.....	255	160	51	0.154	0.876
	Outlet.....	220	125	49	0.143	0.881

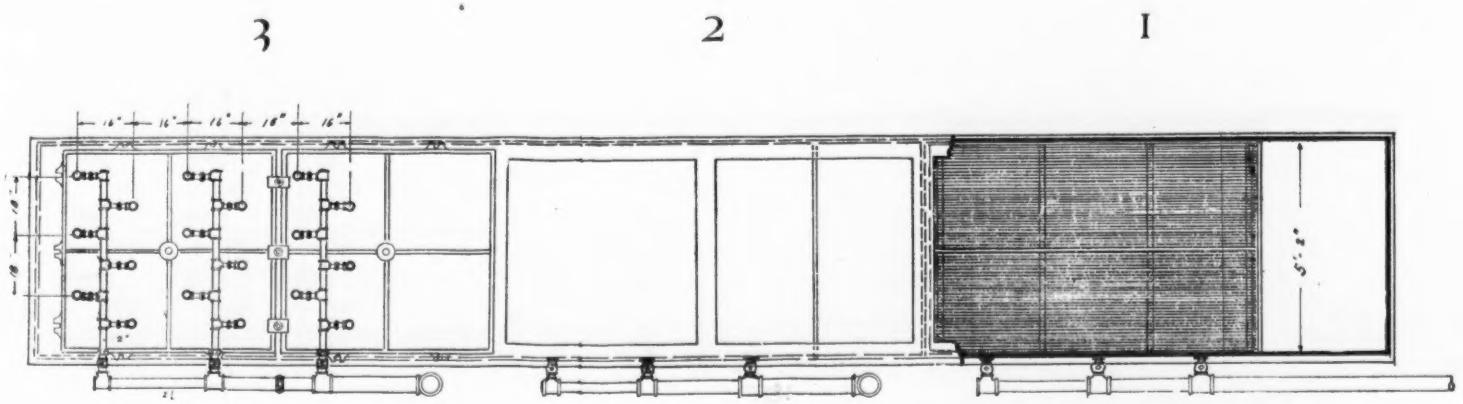
Determination of benzol absorbed by condensate as determined by distillation of tar: Tar per 1,000 cubic feet gas separated in W.C. equal 0.096 gallons, = 0.80 pounds = 363 grams tar per 1,000 cubic feet of gas. Percentage of benzol in tar is 1.3 per cent.; grams of benzol per cubic foot of gas lost in W.-C. = 0.363 × 0.013 = 0.005. What is probably a more trustworthy indication of the work done by the washer-cooler can be obtained from the works' results. These showed a saving during the 12 months succeeding the installation of the washer-cooler over the 2 years previous of 0.254 gallons of oil per 1,000, a consummation distinctly satisfactory. I do not wish to be considered as holding a brief for the washer-cooler. It can only be regarded as one method by which the principles laid down at the beginning of this paper can be successfully applied to water gas condensation. The basic ideas that a consideration of the laws of vapor tension force upon us are:

First.—That slow condensation, in which tar fog formed is carried along with the gas at a diminishing temperature, is ruinous to candle power, owing to the tendency of the tar fog to come rapidly to equilibrium with the gas at these reduced temperatures, when its specific capacity for absorbing benzol is much greater than at the temperature at which it was formed.

Second.—That, disregarding the naphthaline question, as we can generally afford to do in water gas practice, a successful system of condensation must be one which will remove tar fog or condensate at comparatively high temperatures, as soon as formed, so that it will not have an opportunity to get into equilibrium with the gas, with respect to benzol, at that final temperature at which the gas must enter the mains.

There is no reason why this system cannot be applied to coal gas manufacture, always providing that the outlet temperature of the gas from the condensers is at least as low as any temperature it will afterwards encounter. If, after we have removed the tar at a comparatively high temperature, the gas is further washed and cooled, the effect will be that only a small amount of comparatively heavy oils will be removed, together with the naphthaline in excess of that necessary to saturate the gas at the outlet temperature. Candle power will not be affected, because there is not enough benzol in the gas to saturate it, even at the minimum temperature, and the amount of condensate extracted after the removal of the tar is so small in volume that it will have practically no effect in absorbing benzol according to the tension-equilibrium laws. There will be just that amount of naphthaline in the gas necessary to saturate it at the outlet temperature of the gas. Now, if the gas is not further cooled, there will be no deposition of naphthaline in the mains. We can readily see that outside weather conditions would govern the operation of the condensing system. The minimum temperature encountered by the gas would have to be determined, and the gas at the outlet of the condensers held at that temperature, or sufficiently below to afford a reasonable factor of safety. Of course, if we wish to remove the naphthaline from the gas, so as to let it enter the mains in a really unsaturated condition, we must adopt the method by which the gas and condensate can come to equilibrium of tension at low temperature, which means the absorption of a large amount of benzol; or we must take the tar out first, and further cool it to a temperature considerably below that which it will afterwards encounter. Of these two systems, the last will be by far the more desirable with respect to candle power. The advantages of the washer-cooler system may be summed up as follows:

1. Complete removal of the tar fog at comparatively high temperatures as soon as formed.
2. Fractional condensation, rather, a fractional distillation of the condensate on its way from top to bottom of the washing compartment.
3. Great capacity, the limit of which is yet to be determined.
4. Small ground space occupied.
5. Low initial cost.

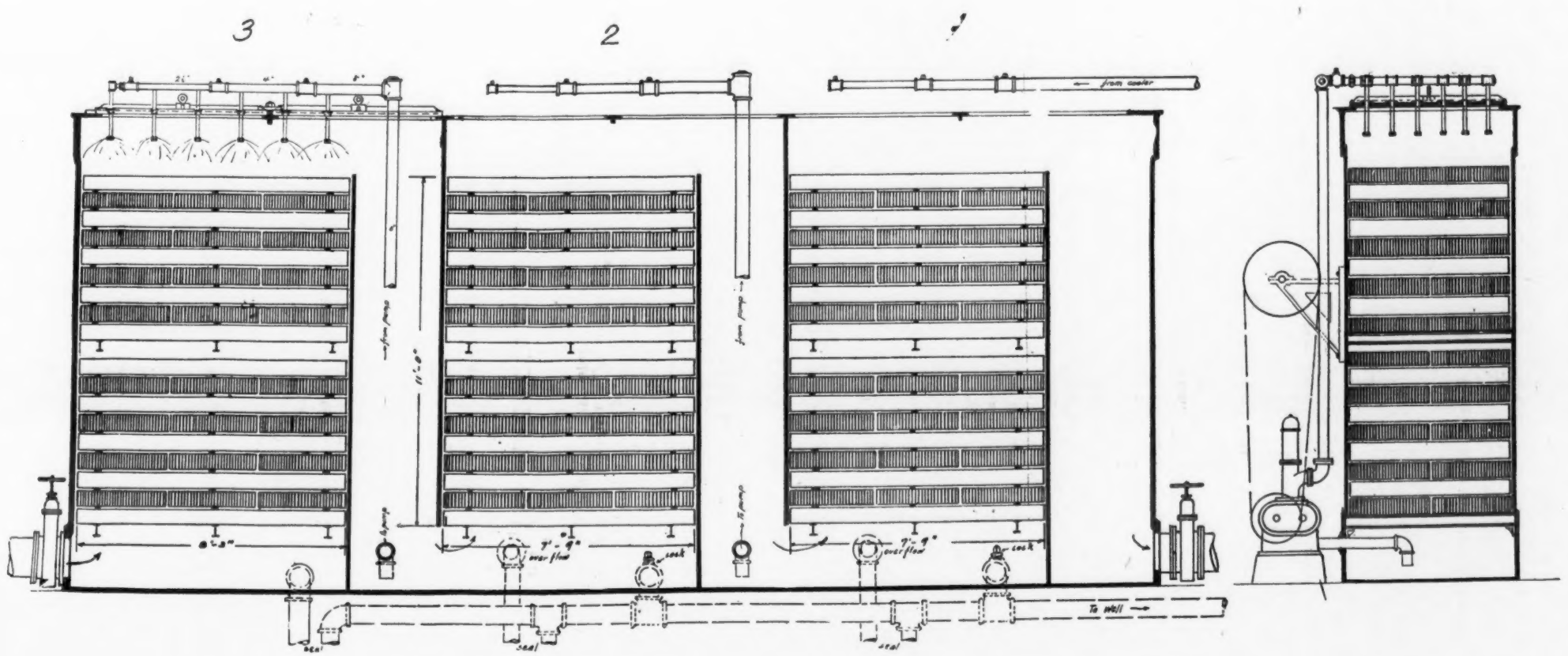


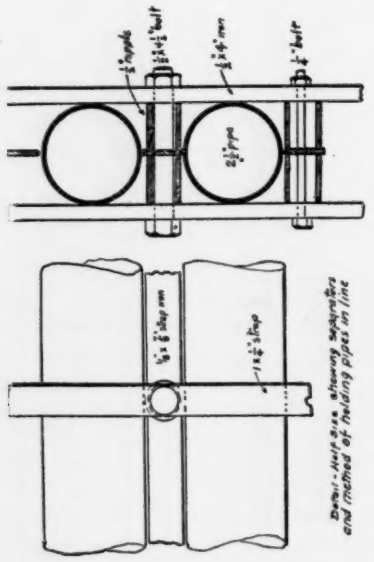
PROPOSED PLAN FOR CHANGING
TUBULAR COAL GAS CONDENSERS
TO A
DOHERTY WASHER COOLER

DETROIT CITY GAS CO

SCALE - $\frac{1}{8}$" = 1'

1-10-10.

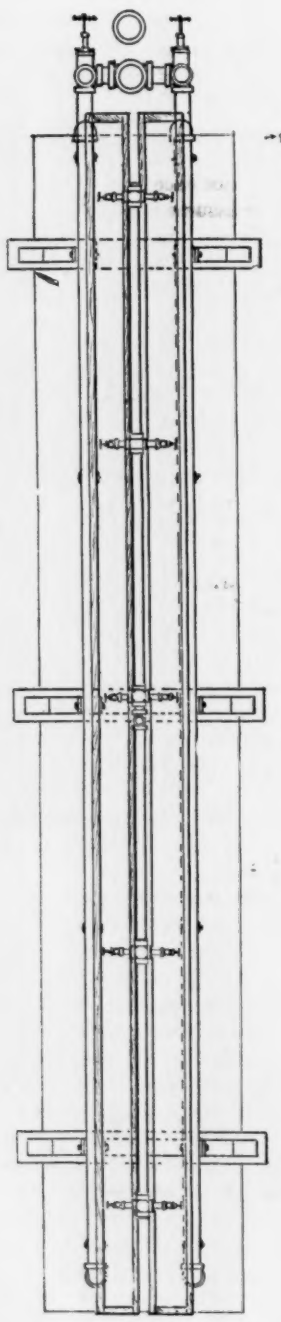


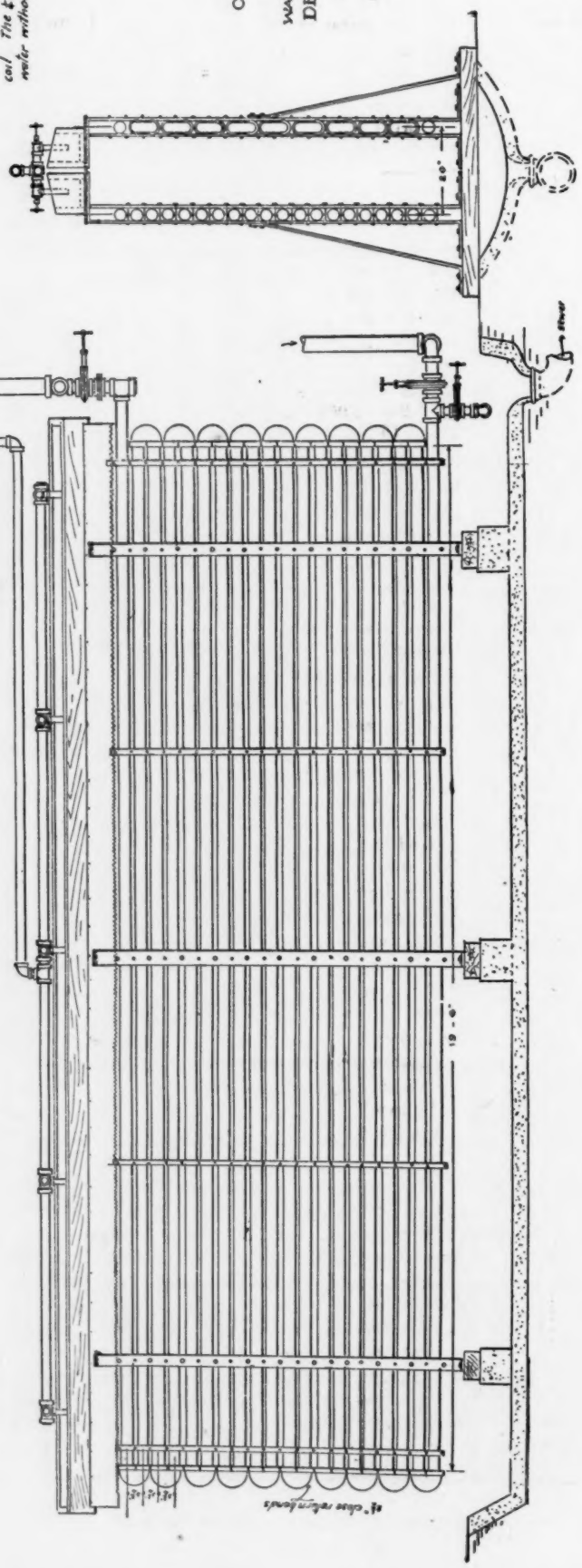


Detail showing Separators and method of holding pipes in line

Note. The cooling water pours over outside edge of troughs, over gutters guide to top pipe of coil. The 4"x4" slags iron between, guides the water without splashing

COILS FOR COOLING LIQUOR FROM WASHER COOLER
WATER GAS PLANT - STATION 'A'
DETROIT CITY GAS CO
2 STAGES - 20 4½"x10' WI SINGLE PIPES IN PARALLEL
EXTERNALLY COOLED
SCALE ⅜"=1'-0" 12-22-10





6. A very considerable decrease in differential pressure through the condensing system.

7. Ability to deliver gas to boxes at higher temperatures, causing more effective purification.

8. Purifying material in good condition when removed from the boxes, which enables us to revivify it more rapidly and use it up to a higher percentage of sulphur.

9. Better oil results, because this system of condensation prevents the absorption of an excessive amount of benzol by the condensate, hence gives us increased candle power.

For these reasons, though the washer-cooler may not be the last word in condensation, it offers such unique and exceptional advantages over the system of slow condensation, that it must come more and more generally into use in modern water gas practice.

(To be Continued.)

(Continued from page 43.)

Insulation as a Means of Minimizing Electrolysis in Underground Pipes.

[Prepared for the Sixth Meeting, American Gas Institute, by DR. E. B. ROSA and MR. BURTON MCCOLLUM.]

Leadite joints when new, also have ample resistance, comparing favorably with cement joints in this respect, but their resistance appears to decrease rapidly with age. This is very strikingly shown in Table IX., which shows the variation of the resistance of some leadite joints with time. A pipe line about 100 feet long was laid with leadite joints, care being taken to make all joints free from metallic contact between the ends of the pipe. At the center of the line the pipes were separated, an insulating plate inserted, and the two ends of the pipe on either side of the insulating plate were provided with insulated leads leading to the surface in which an ammeter could be inserted for the purpose of measuring the current flowing in the pipes from time-to-time. The arrangement for measuring current was essentially the same as with the cement covered pipes shown in Fig. 1. A difference of potential of 15 volts was impressed on this line continuously, which was sufficient to give a drop of potential of about 0.8 volts on each joint. The readings show that the current was very small when the pipe was first laid, but increased rapidly with time, and after being laid 4 months the resistances have decreased to about 1 two-thousandth of their initial value and are still decreasing. At first it was supposed that the apparent decrease in the resistance of the joints might be due to increased leakage around the joints but measurements made of some of the joints when uncovered show that the resistance of the joint itself has decreased. The resistance of these joints is still high enough, however, to be quite effective in reading currents in the pipes to a safe value under ordinarily severe conditions, but whether they will ultimately fall to so low a value as to render the joints worthless is a matter that only a long time test can show, and the tests on these joints will be continued until this point has been definitely determined.

TABLE IX.—*Showing Variation of Resistance of Leadite Joints with Time.*

Date...	July 7.	July 14.	July 21.	July 28.	Aug 11.	Aug. 25.	Sept. 8.	Sept. 19.
Current....	0.0069	0.0076	0.046	0.268	0.064	0.360	1.24	1.88
Resistance..	2,174	1,990	326	56	23	41	12	8-ohms.

A condition already referred to that is likely to cause trouble is a too infrequent use of insulating joints, and this condition is probably responsible for most of the disfavor into which this method has fallen in some quarters. Obviously, if the joints are placed far apart the long stretch of intervening pipe may pick up considerable current and since most of this current must flow out of the pipe as it approaches the insulating joint, serious electrolysis may occur on the positive side of the joint. The more frequently the joints are placed the less the danger from this source. It is, of course, impossible to lay down any very definite rules in regard to the frequency with which such joints should be used, since that must be determined in each case by local conditions. In general, however, it may be said that the resistance joints should not be confined to the positive area, as some have supposed, but should be distributed throughout the negative and neutral areas also. All lines which run nearby, or cross under, street railway tracks are generally most in need of resistance joints.

In many cases, where there is good reason for believing that the drop of potential is fairly uniformly distributed throughout the entire region in which the insulating joints are to be placed, it is sufficient simply to determine the total difference of potential between the ends of the line affected and use this value in determining the number of insulating joints that are needed in order that the drop of potential across each joint shall not exceed a predetermined value. It often happens, however, that the potential gradient may vary greatly in different portions of the line, and if the joints were uniformly spaced in such cases, the joints would either be more frequent than necessary in some places, or too few in others, and the condition of maximum of protection at a minimum cost would not be realized. This condition is very likely to occur where a pipe line runs at right angles to railway lines, in which case the potential gradient along the pipe will often be many times greater at points within a short distance on either side of the track than at more remote places. Other conditions, such as the presence of other pipe systems, may also disturb the uniformity of the potential drop.

In some instances, as in laying new lines where some cheap type of joint is being used, it may often be cheaper to allow a liberal factor of safety and install enough joints to be safe under any conditions that may arise; but in other cases, as for instance, where insulating joints are to be inserted in large and important mains already laid, where the cost of the joints is an important matter, and where interruption of the service is a matter of serious moment, it is important that no unnecessary joints be used and that these be so placed that they will be most effective in reducing current flow in the pipes, and so there will be no danger of developing a high enough difference of potential across the joint to cause trouble. For this reason, before attempting to install a series of insulating joints for the purpose of preventing electrolysis, in cases where it is important for economic or other reasons to use as few joints as possible, it is important (first) to make a careful potential survey of the district to be affected, and determine the magnitude of the potential gradients in a direction parallel to the pipe lines. This will enable one to determine in advance the approximate number of joints that will be necessary, and also the proper location of the joints, so that the drop of potential across any joint may not exceed a certain amount. If a new line is to be laid it is safe to assume that the average potential gradient after the pipe has been laid will not differ greatly from that which prevails before-hand, provided the joints are used at proper intervals; but the distribution of this potential gradient will be greatly altered, practically all of the fall of potential occurring at the joints. The average drop of potential across joints in any given portion of the line will be approximately equal to the total drop divided by the number of joints. When insulating joints are to be placed in old lines, it is well to bear in mind that the insertion of the joints in the pipe will, in general, increase the potential gradient along the pipe. This increase may reach as much as 100 per cent. or more, and allowance should be made for this.

In actually measuring the potential gradients in the earth special precautions must be taken if trustworthy results are to be obtained. Some form of non-polarizable electrode must be used, and so designed that the resistance of the earth immediately surrounding the electrode will not produce a large enough drop of potential under the flow of the voltmeter current to affect seriously the readings of the instrument. To accomplish this the surface area of the non-polarizable terminal should be large, and it should be used in connection with a high resistance voltmeter having a high current sensibility. A form of electrode which we have found satisfactory for this purpose is a modified form of the Haber electrode, shown in Fig. 6. A wooden rod, about 3 feet long and 1 inch in diameter, is provided at one end with a copper sheath about 6 or 8 inches long. To this sheath an insulated wire is connected and carried up along the rod to be used as connection to the voltmeter. The copper sheath is then placed in a cylindrical, porous, enclosure somewhat larger than the sheath and the intervening space filled with copper sulphate crystals. Hollow cement cylinders, about 2 inches in diameter and slightly longer than the copper sheath, have proven satisfactory for this purpose. Two of these electrodes are used, and when it is desired to measure the difference of potential between any two points in the earth, holes are drilled into the earth at the desired points, to a depth of a foot or more, by means of a crowbar or other suitable tool, and these filled with copper sulphate solution or water, into which the non-polarizable electrode is immersed to a depth sufficient to cover the copper sheath. The insulated copper leads being connected to the terminals of a suitable voltmeter, the difference of potential can be determined, which will be practically free from errors due to polarization.

After a series of joints are installed the only method of determining experimentally whether or not a sufficient number of joints has been installed is by measuring the drop of potential across each joint and by measuring current flow in the pipes. If the joints are too few in number in any locality, there will generally be too high a voltage

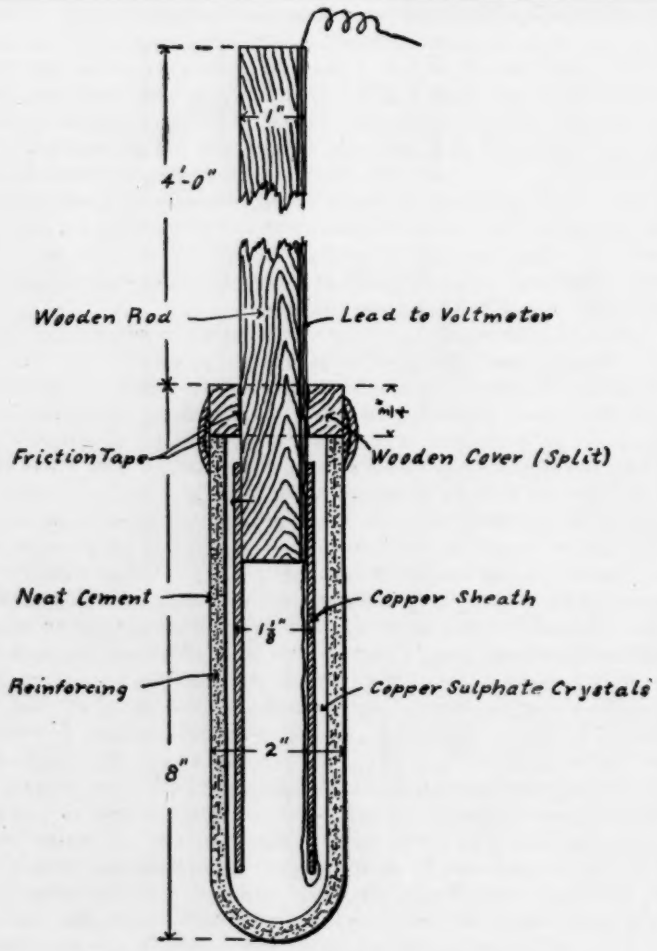


Fig 6.

across the joints, and thus the consequent heavy leakage current may injure the pipe on the positive side of the joint. The voltage that can be safely permitted is a matter which depends on a variety of conditions, such as the nature of the soil, kind of joint used, etc., and can only be roughly indicated here. Careful observation of joints under average conditions for a considerable period, together with laboratory experiments to be given later, indicates that a drop across the joint of from 0.1 to 0.4 volts can usually be regarded as safe. The lower limit applies to pipes located in low wet places, and to joints having a short leakage path between the sections of the pipe, and the upper limit to pipes in comparatively dry soils and to joints having a long leakage path. This matter of the length of the leakage path around the joint is an important one, and is treated at some length later in discussing the relative value of different kinds of joints. If the joints used have not a very high resistance, as when leadite is used, for instance, considerable current may flow through the joints without making a dangerous drop across the joint, and the currents thus collected in a large number of branch lines may ultimately be carried to a few lines in a remote quarter and there give rise to serious damage. As to whether current flowing through the leadite involves danger to the joint has not yet been determined. In order to guard against this, current measurements in the pipes should also be made. If in any line any considerable current is found to be flowing, or if the voltage across the joints exceeds considerably the limits mentioned above, additional joints should be installed.

One of the problems encountered in attempting to protect a pipe system by the use of resistance joints is the effect of other pipe systems in the same territory not so protected. Gas and water systems, for instance, are often brought into metallic contact with each other in many places, and this greatly increases the difficulty of protecting either system alone by the use of resistance joints. This difficulty could be largely avoided by inserting an insulating joint in the service pipe inside of the building in which metallic connection with the other system is made. There are other complications, however, which are not so easily dealt with, and where an uninsulated pipe system occupies the same territory with an insulated system isolated cases of electrolysis are likely to occur.

When a line having insulated joints must be connected to another line not so insulated, trouble may be experienced due to the tendency to develop with potential drops across the joints in such places, particularly if the uninsulated pipe line is at a potential considerably different from that of the earth, either positive or negative. This condition is especially likely to occur if the uninsulated main is connected to negative return feeders and those insulating joints, which connect the insulated lines to those having the negative feeders attached, are often subjected to unavoidable differences of potential that may be sufficient to destroy the joint in a short time. For this reason the use of insulting joints and negative return feeders in the same system is not to be recommended.

The difference of potential that can safely be permitted across a joint presents a problem of great importance and one to which comparatively little study has been given. Some of the factors governing this are mentioned above, and one of the most important of these is the type of joint used. It is well recognized that the actual damage due to the discharge of current from a pipe depends not so much on the total quantity of electricity discharge, but mainly on the distribution of the discharge. If the current leaves the pipe uniformly over a large surface a much longer period must elapse before serious damage will result than if the intensity of current discharge is much greater at some points than others, so that condition which tends to prevent concentration of discharge will correspondingly reduce the danger. As already shown, pipes, even when provided with insulating joints, will carry some current; and especially, if the joints are not very frequent, considerable current may be found, and since with high resistance joints most of this current must leave the pipes at every joint, it becomes important to determine as accurately as possible what the distribution of this discharge may be and to find how this distribution may be made most nearly uniform.

To determine something of the effect of the form of the insulating joint on the distribution of current around the joint, 3 perfectly insulating joints were made of 4-inch cast iron pipe, 1 a bell-and-spigot joined by paraffine; the second, a butt joint with ½ inch of paraffined wood separating the pipes; and the third, a similar butt joint with 5 inches of paraffine wood between the pipes. The arrangement of the apparatus is shown in Fig. 7.

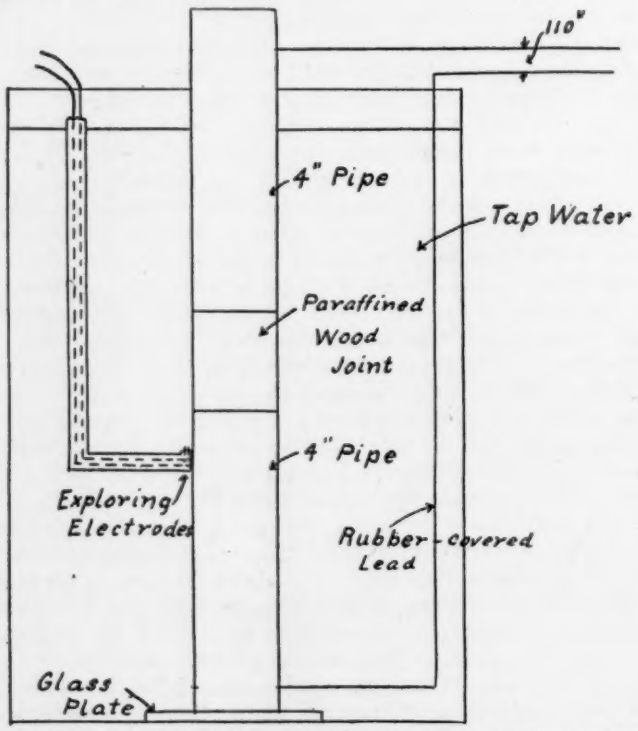


Fig. 7.—Scale, 1½ Inches = 1 Foot. Arrangement of Apparatus for Exploring Current Distribution at Insulating Joints.

The pipes in succession were placed coaxially in a cylindrical tank of water, 23 inches in diameter and 32 inches in depth, with the joint near the center of the tank. The bottom of the tank was covered with a layer of paraffine and the end of the pipe rested on a glass plate. Rubber covered leads, attached to the pipes 14 inches from the joints, permitted the impressing of voltages from 4 to 11 volts.

An L-shaped, 2-conductor, rubber insulated, cable was lowered into the water, the plane of the L being kept radial to the pipe, and the end of the L bent upward so that the line joining the exposed ends of the wires at the terminus of the L was normal to the surface of the pipe. Since the specific resistance of the water was substantially

uniform throughout, the potential gradient at any point was proportional to the intensity of the current at that point, so that, by measuring the difference of potential between the two exposed ends of the wires, when placed as close as practicable to the surface of the pipe (about 0.04 inch), the potential gradients thus obtained, divided by the specific resistance of the water, gave the intensity of current at that point; and, by raising or lowering the L, the intensity of current discharge at any point could be found. The specific resistance of the water used was 5.620 ohms per centimeter cube, which is about the mean of that of a large number of samples of earth taken from various places in city of Pittsburgh. It was necessary to impress rather high voltages across the joint in order that the potential difference between the terminals of the L should be large enough so that the reading would not be seriously affected by polarization at the terminals. From 20 to about 100 volts were used, according to the type of joint under test. The results of the tests are very strikngly shown in the curves of Fig. 8, in which the intensity of current

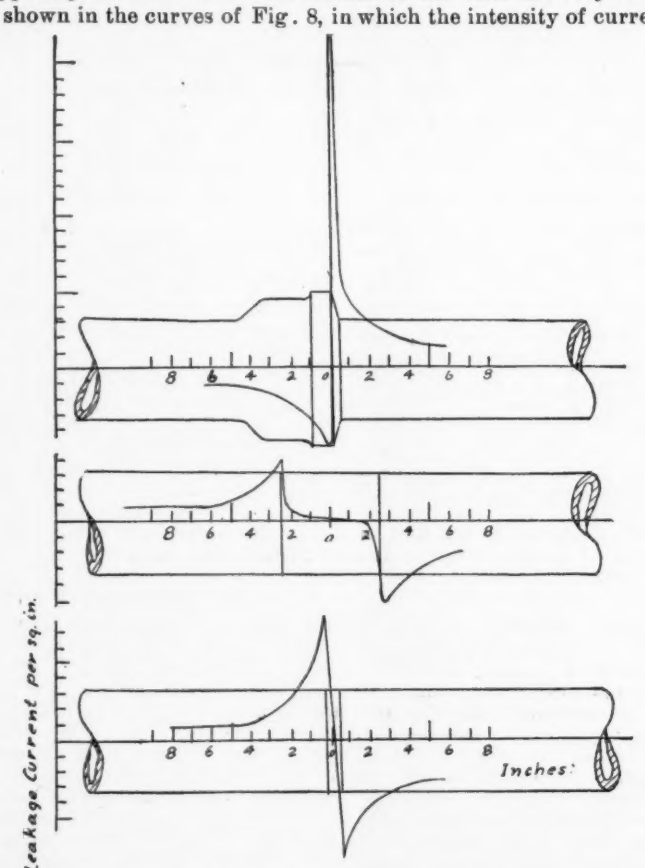


Fig 8.—Curves Showing the Effect of Various Insulating Joints on the Distribution of Leakage Current around the Joints.

discharge is plotted as a function of the distance along the pipe for some distance on each side of the joint. In each case the axis of the pipe is taken as the zero axis of current, and positive values represent flow of current away from the pipe. While negative valves represent current returning to the pipe. For convenience in making comparisons all the readings are reduced to values corresponding to a difference of potential of 20 volts across the joint. The curves indicate that the form of the joint has a most decided effect on the distribution of current discharge. The bell-and-spigot type shows a very high density of current just under the edge of the bell indicating a very high rate of corrosion at that point. The butt joint, shown at the bottom, having a length ½ inch, shows a much better distribution of current, the maximum intensity being about ¼ that in the case of the bell-aud-spigot joint. With the joint 5 inches long still further reduction in the height of the peak is shown, the maximum intensity of discharge being only 15 per cent. of that of the bell-and-spigot type. It is also very interesting to note that the total flow of current about the joint does not differ greatly in the 3 cases, the resistances of the leakage path being 68, 72 and 87 ohms in the bell-and-spigot, ½-inch and 5-inch joints, respectively. Particularly significant is the comparison of the 2.butt joints in this respect. Although one is 10 times as long as the other, the resistance of the leakage path is increased by less than 30 per cent. This shows the unwisdom of attempting to reduce the current flow in a pipe line merely by increasing the length of a few joints. The short joints are, as a rule, much cheaper and easier to install and they can, therefore, be installed much more frequently for the same total cost. As a rule, therefore, it would appear preferable, in installing a line of insulating joints, to use a large number of short joints rather than a few long ones, as in this way the current in the pipes can be kept at a much lower volume, and the relatively large number of joints will usually be sufficient to prevent any serious potential drop across the joint. In some cases, however, as where the insulating joints are discontinued, or where, for any reason, it is desired to use but a few joints, or to place them in places where high potential differences are unavoidable, the above tests show that the long joint is much to be preferred, because of its effect in preventing great concentration of current discharge near the edge of the joint.

The above data furnished also a basis upon which can be made a roughly approximate determination of the voltage drop which may be permitted across a joint of the types tested. It can be shown that the rate at which corrosion will penetrate the iron is given by the formula $L = \frac{C}{D} \times \frac{P}{S}$ where L is the rate at which the corrosion penetrates the iron expressed in centimeters per year; C is the electrochemical equivalent of iron; D its density; P the average potential gradient in volts per centimeter normal to the pipe at the point considered; and S is the specific resistance of the iron in ohms per centimeter cube. The assumption is here made that the efficiency of corrosion is 100 per cent. For cast iron the value of $\frac{C}{D}$ is about 1,280, and the equation becomes $L = 1{,}280 \cdot \frac{P}{S}$. Assuming 5,600 ohms per centimeter cube as the specific resistance of the soil, and a drop of potential of 0.4 volts across the joint, and determining from the curves in Fig. 8 the current maximum intensity reduced to this voltage we get as the maximum rate of penetration of the corrosion in inches per year:

Character.	Inches, Per Year.
Bell-and-spigot joint	0.034
½-inch wood joint	0.009
5-inch wood joint	0.004

The time required for the corrosion to penetrate clear through a pipe ½-inch thick containing these joints is, therefore, as follows:

Character.	Years.
Bell-and-spigot	14.7
½-inch wood	53.4
5-inch wood	121.0

The permissible drop across a joint in ½-inch cast iron pipe for a life of 40 years is as follows:

Character,	Volts.
Bell-and-spigot joint	0.147
½-inch wood	0.53
5-inch wood	1.22

In considering these figures it is well to remember the corrosion here indicated is that due to electrolysis, and is in addition to the corrosion occurring due to the soil or water. It should be added that we have found specific resistance as low as 1,100 ohms per cm. cube, and under such conditions the rate of corrosion may be 5 times that computed above. Further, the effect of surface resistance due to paints, etc., and the effects of polarization under low voltages, are not here considered, so that considerable variations from the calculated values may be expected. These calculations are of value only in that they indicate that a drop of potential across a joint can hardly be considered safe, if it exceeds a few tenths of a volt, and that much can be gained by the use of a long leakage path where voltages are expected to be high. This problem is an important one, and much additional work remains to be done in this direction.

(To be Continued.)

[Continued from Page 46.]

PROCEEDINGS, SEVENTH ANNUAL CONVENTION, NATIONAL COMMERCIAL GAS ASSOCIATION.

Held in Denver, Col., October 24 to 28, 1911.

Third Day—Afternoon Session.

The President introduced Mr. W. M. Blinks, of Kalamazoo, Mich., who read the following paper on

COMPARATIVE COSTS AND EFFICIENCY OF GAS, ELECTRIC AND GASOLINE LIGHTING.

The comparative costs of gas and electricity for lighting have been generally accepted as much in favor of gas. Electrical selling argu-

(*Continued on page* 60.)

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NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, JANUARY 22, 1912.

[Official Notice.]

Forty-Second Meeting, New England Association of Gas Engineers.

New England Association of Gas Engineers,
Office of the Secretary,
East Boston, Mass., Jan. 1, 1912.

The Forty-Second Annual Meeting of the New England Association of Gas Engineers will be held Wednesday and Thursday, February 14th and 15th, 1912, at Young's Hotel, Boston.

Papers are being prepared on:

High Pressure Distribution. Gas Office Buildings. Industrial Appliances. Producer Practice in Water Gas Making. Shavings Scrubbers. Measurement of Flow in Mains. And on other subjects of interest.

Members will dine together Wednesday evening.

Those who wish to join the Association should send in application to the Secretary before the meeting. N. W. Gifford, Secretary.

[Official Notice.]

Annual Meeting, Illinois Gas Association.

Illinois Gas Association,
Temporary Office of Secretary,
Dixon, Ills., January 17, 1912.

To the Members, Illinois Gas Association: The next annual meeting of the Illinois Gas Association will be held in the Auditorium Hotel, Chicago, under dates of March 20th and 21st, 1912. Announcements as to papers to be discussed will shortly appear in this Journal.

F. E. Newberry, Secretary.

[Special Editorial Correspondence by Telegraph.]

FOURTH ANNUAL MEETING, INDIANA GAS ASSOCIATION.

The Claypool, Indianapolis, Ind., Jan. 18, 1912.

Dear Journal: The Fourth Annual of the Indiana Gas Association was in full swing yesterday, under the able direction of President S. E. Mulholland, who was looking his brightest and doing his best (and none else could do better) every minute. In fact, he commenced the proceedings by giving a dinner, in this tip-top abiding place, the evening of the 16th, his especial guests being the executives of the Association, meaning the Directors, too. At 10 A.M. of yesterday that "noblest Roman of them all," Hon. Thos. R. Marshall, Governor of the State, welcomed the Association in hearty fashion. In fact, his speech was, in good part, a State paper, defining the advantages that come to company and consumer through the working of Utilities Commissions; nor was the Governor at all slow in pointing out wherein and under what circumstances regulation of the sort noted might be rendered boomful rather than beneficial.

Secretary Eves sprung an agreeable surprise in his report, which showed a net increase in membership of 37, which is now returnable (close of 1911) at 98 active and 48 associate. The muster roll also bears evidence of the hold the Association has on the industry at large, in that the names of many officials of companies on the executive side have been enrolled. President Mulholland's address was a business like (and scholarly as well) presentation of how advanced principles obtained to favor gas trading increase and the promotion of friendly relations with the public at large. Of course, it is no new manifestation on Mr. Mulholland's part, this putting out of hearing the "public be?" slogan. Only one paper was read during the morning session—that by Mr. H. Kaufman, on "Securing New Business and Increasing the Sale of Gas Per Meter in Small Cities." However, it was of sufficient length to cause the discussion to be put over until the afternoon.

After luncheon the members travelled in special car to the laboratory and lecture room of the Eli Lily Company, wholesale druggists in Indianapolis, where a complete equipment of gas and other chemical apparatus, enabled Dr. S. W. Parr, Professor of Applied Chemistry, University of Illinois, to effectively illustrate an excellent lecture on "Calorimetry," and a talk (also nicely illustrated) on "Surface Combustion." These topics, of a positive certainty, were amply sufficient to repay any expenditure of time and money incurred by any delegate in attending these sessions.

The entertainment for the first evening included a first rate dinner, served in the Claypool's best style. It was accompanied by a programme of songs, speeches and informal offerings that caused no end of enjoyment. A local song "The Jolly It Boys" was especially taking, and it actually went with a roar, to the accompaniment of "Yankee Doodle." After dinner an invasion of the Grand Opera House was made, and the march was so successfully and irresistibly directed that it did not cease until the front rows had been reached. The "artists," spurred on by some impromptu prompting, entered into the spirit of the affair with such levity that the average specific gravity of the show did not exceed .412. The miserable thing in connection with the first day was the knowledge that "Our own Jim." Dunbar was prevented by illness from attending the sessions. —I. G. A.

The Claypool, Jan. 19, 1912.

Dear Journal: One would fear that the "front row trance" of the first evening would have interfered with the attendance on the second day. Not so, however, for 110 greeted "Mull." when the business order was called for. And here we had the genuine surprise of the meeting. Shortly after the regular order had been announced, the President announced the presence of Mrs. O. N. Guldlin (wife of Mr. Olaf N. Guldlin, and Chairwoman of the Home Economies branch of the Federation of Women's Clubs), who formally introduced that clever woman and charming lady to the Association. In well-chosen speech she read a paper on the matter of "Our Mutual Interests;" and, take it from me, the N. C. G. A. should get busy forthwith over putting that paper of Mrs. G.'s in the hands of every housewife resident in a district supplied with gas. The balance of the papers listed (save that by Mr. T. A. Elder) came in for due consideration, the concluding number being that by the Dean of the Association (Mr. W. Wallace), whose Reminiscences of 44 Years in the Gas Business" brought the technical matters to a closing. The officers elected were:

President—Howard L. Olds.
Vice President—Wm. Wallace.
Secretary-Treasurer—Philmer Eves.
Directors—Carl H. Graf, D. A. Barnes, A. C. Cooke, A. C. Blinn and G. M. Dolley.

The number of Directors was increased to 9 from 6, and the next meeting place will be Indianapolis, the date to be selected by the Directors. The usual votes of thanks brought to a close the best attended, most enthusiastic and useful meeting of the Association.—I. G. A.

BRIEFLY TOLD.

Annual Meeting, Illuminating Engineering Society.—The Illuminating Engineering Society held its annual meeting, the evening of the 12th inst., in the rooms of the Machinery Club, 50 Church street, New York city. The meeting, which was preceded by a dinner, was attended by 100 members and guests. President Kennelly acted as toastmaster and proved again his ability as a presiding officer and a wit. He introduced the following, whose speeches were chiefly along the idea of co-operation: Mr. Gano Dunn, President, American Institute of Electrical Engineers; Mr. Walter Cook, President, American Institute of Architects; Hon. Ira C. Copley, President, American Gas Institute; Dr. A. C. Humphreys, President, American Society of Mechanical Engineers; Mr. R. B. Shrover, President, Iron and Steel Electrical Engineers; Dr. Martin, of the School of Architecture, Cornell University; and Dr. W. H. Tolman, Director, American Museum of Safety. That the gas industry was well represented

needs no comment. Following the formal speeches, Dr. Kennelly abstracted the report of Secretary Millar, which will bear careful study, as it was in line with the previous reports of that capable executive. The membership numbers 1,318, and the treasury shows a balance on the right side of the ledger. The report of the committee of tellers was to the effect that the following officers were elected:

President.—V. R. Lansingh.
Vice-President.—Norman Macbeth.
General Secretary.—P. S. Millar.
Teasurer.—W. J. Serrill.
Directors.—C. J. Russell, A. J. Marshall and R. C. Ware.

The speech of acceptance of Mr. Lansingh had to do mainly with a suggestion to change the name of the Society by eliminating the word engineering. There was no discussion, owing to the lateness of the hour; but much comment was heard at variance with the suggestion. The advancing of purely commercial reasons for a proposed change in name are rarely sufficient causes for disrupting a successful organization. If there is no need for an Illuminating *Engineering* Society, there certainly would seem small need for illuminating engineers. In further proof that the Society has a field of usefulness as an engineering society just look over the roster of gentlemen who spoke at the annual meeting. Would these attend a gathering of aesthetic (or other) makers of glassware? The speech noted was the one that sounded a discordant note in an otherwise enjoyable session, which was shared in by the following men well known to the gas profession: G. G. Ramsdell, Drs. A. H. Elliott, Louis Bell and E. B. Rosa and Messrs. W. C. Morris, C. O. Bond, Norman Macbeth, F. H. Gilpin and L. B. Eichengreen.

OBITUARY NOTE, MR. DAVID WALKER.—Mr. David Walker died Sunday morning, December 31, 1911, at his home in Lockport, N. Y. He was born in Markham, England, April 24, 1849. He came to this country in 1887, and soon thereafter procured employment in the Lockport Gas Company. In 1888 he was appointed its Superintendent, a position which he worthily filled until his death. As evidence of his faithfulness, it was often said of him that he worked as if every brick in the plant were his own. Mr. Walker's death is keenly felt by the Company and by his fellow-employees in the Lockport Light, Heat and Power Company. He commanded the respect and affection of everyone with whom he was associated. His son (Mr. Ed. M. Walker) is General Manager of the Citizens Railway and Light Company, Muscatine, Ia. For the main facts in this connection we are indebted to the attention of Mr. C. M. Kaltwasser, Manager, Lockport Light, Heat and Power Company.

MR. PRESTON S. MILLAR, General Secretary of the Illuminating Engineering Society, informs us that a meeting of the New England Section of the Illuminating Engineering Society is to be held the evening of Monday, January 22d, in the auditorium of the Edison Electric Illuminating Company, of Boston, 39 Boylston street. Three papers, dealing with artificial daylight, are scheduled. The papers to be read respectively by Messrs. H. E. Ives, R. B. Hussey, and C. H. Sharp and Preston S. Millar.

OBITUARY NOTE, MR. FREEMAN C. SHERMAN, SOCIETY OF GAS LIGHTING.—At the December meeting, Society of Gas Lighting, a Committee was appointed to report suitable minutes to the memory of Mr. F. C. Sherman, and subsequently the Committee submitted the folfowing:

The members of the Society of Gas Lighting have learned with sorrow of the death of their friend and fellow-member, Freeman C. Sherman, which occurred December 18th, 1911, at his home in New Haven, Conn. Mr. Sherman was elected a member of the Society in 1876; and until recent years, when failing health prevented, was most regular and constant in attendance at its meetings, doing his full part in contributing papers and in the discussion of various matters brought to the attention of the members. He spent his entire life in the gas business: First, at Ware, Mass., then (1858–9) as Superintendent at Newport, R. I.; from 1859 to 1870 as Superintendent and General Manager, Brookline, Mass.; from 1870 to 1875 occupying the similar positions at Worcester, Mass.; and from 1875 to 1903 as Engineer and Superintendent at New Haven, Conn. Since the last date, when he gave up active work, he has been the Consulting Engineer of the New Haven Company—a period of more than 53 years in the one line of work; and, during most of these years, he was an active, influential force in the gas business.

He was a charter member of the New England Association of Gas Engineers, a member of many other American Gas Associations, a frequent attendant at the various meetings, and for a long time was one of the best known men in our line of work in the whole country.

He was a very genial, pleasant man to meet; and that quality, combined with his good judgment and his long and wide experience, made him one of the men whose opinions were sought by many people at many times on matters connected with the business.

He was honest and conscientious in his work, devoted to the interests of the Company employing him; and whatever he did or tried to do, he gave the best there was in him, regardless of himself or his own personal convenience. He was one of the last of those wholesouled, loyal, able men, who, without technical training, contributed so largely in placing the gas business on a firm foundation in this country.

To his family we extend our heartfelt sympathy in their great loss, and beg to assure them that their loss is shared by a large number who, knowing Mr. Sherman well, liked and respected him for his many good qualities of head and heart.

[Signed.] CHARLES H. NETTLETON, W. H. BRADLEY, A. H. STRECKER, } Committee.

CURRENT MENTION—

"B.," WRITING from Louisville, Ky., under recent date, informs us that the city of Louisville has filed a second amended answer in the suit of Z. T. Underwood against the Kentucky Heating Company, the Kentucky Fuel Gas Company and the City of Louisville. The city, in the answer and cross-petition asks for $100,000 damages for the wrongful use of streets, and that the Kentucky Fuel Gas Company be compelled to remove its pipe lines. The suit originally filed by Z. T. Underwood charged that the Kentucky Heating Company and the Kentucky Fuel Gas Company were operating without a franchise. He prayed that the defendant Companies be compelled to pay the city $50,000 damages for the wrongful use of the streets.

"T. L.," writing from Albany, N. Y., under date of the 17th inst., reports that the Newport News and Old Point Railway and Electric Company will hereafter operate the gas, electric light, railway and ice plants which caters to the needs of the public (in the suggested respects) of Newport News, Hampton-Phoebus and Old Point Comfort. The firm of Allen, Peck and associates, of Schenectady, N. Y., will manage the operating end of the business; and although Mr. C. L. Allen, Vice-President and General Manager of the Utica and Mohawk Valley (N. Y.) Railway, was chosen President of the Newport concern, and Mr. E. F. Peck, General Manager of the Schenectady (N. Y.) Railway Company, was chosen Vice-President, these duties will not affect either in his relation to the named New York activities of both.

AT the annual meeting of the City Gas Company, of Ardmore, Okla., the officers elected were: President, H. W. Mensche; Vice-President, O. J. McLane; Treasurer, J. S. Connelly; Secretary, H. W. Milton.

AT the annual meeting of the shareholders in the Sacramento (Cal.) Natural Gas Company the officers elected were: President, W. F Boardman; Vice-President, W. F. Knox; Treasurer, Geo. W. Peltier; Secretary, H. C. Keyes.

Papers have been filed with the Secretary of State of Texas, certifying to the incorporation of the Citizens Gas Company, of Henrietta Clay county. It is capitalized in $50,000, and its incorporators are Messrs. A. B. Edwards, J. T. Dale, W. B. Worsham and J. E. Dale.

THE Department of Electrical Engineering, Pennsylvania State College, now owns a specially designed harmonic set, manufactured by the General Electric Company. It consists of three 3-phase alternators, the largest of the three machines being mounted on the same shaft. The largest of these generators is for 60-cycle, the second one for 180 cycle, the third for 300-cycle. The pressure waves developed by all three machines, or by any two of them, may be superposed, and the waves themselves may be displaced by any desired amount. The harmonic set, in connection with the 3-element oscillograph purchased several years ago, provides equipment for exhaustive study along certain lines of alternating current theory not found in any other college electrical engineering laboratory in this country. This equipment, in fact, is the second of its sort manufactured, the first example being in the possession of the Electrical Testing Laboratories, New York. The apparatus was purchased primarily to permit Prof. C. L. Kinsloe to continue his experiments on incandescent filaments. The initial report of his experiments was published in one of the Bulletins, issued from the Engineering Experiment Station of Pennsylvania, located at State College.

MR. H. R. BASFORD, of San Francisco, Cal., is representing the Sprague Meter Company, on the Pacific Coast, north of San Francisco. He has in this connection opened a warehouse in San Francisco, wherein he will carry complete lines of the Sprague Company's goods.

MR. J. H. HAGGERTY, General Manager of the Americus (Ga.) Gas and Electric Company, appeared last Wednesday before the Railroad Commission of Georgia, arguing for authority to issue $340,000 guaranteed by the properties of the Americus Gas and Electric Company.

"T. D. M.," writing under date of the 13th inst., from Macon, Ga., says: "I was in Americus last week, and had the good fortune to witness the results emanating from General Manager Haggerty's new electric light plant, just completed. As I understand it Mr. H. is altogether responsible for this installation; it certainly looks that the Company is to be congratulated on having such a clever chap at the head of its trading."

SOME time ago the Consumers' Gas Company, of Toronto, Ontario, asked the City Council for permission to erect 14 ornamental iron posts, on Toronto street, opposite the office, the posts to carry an example of outdoor lighting by means of modern gas lamps, Ald. Anderson, voiced serious objection (at least he said it was serious), on the ground that the scheme was merely one to advertise the Company's gas, which advertisement was to be made on the city's premises. The Company was to perform the extra illumination without during the experimental stage. Mayor Geary also opposed the petition on the ground that Ald. Anderson's objections were O. K. The other members, however, sent the plan along one further step towards favorable finality.

(*Continued from p. 57.*)

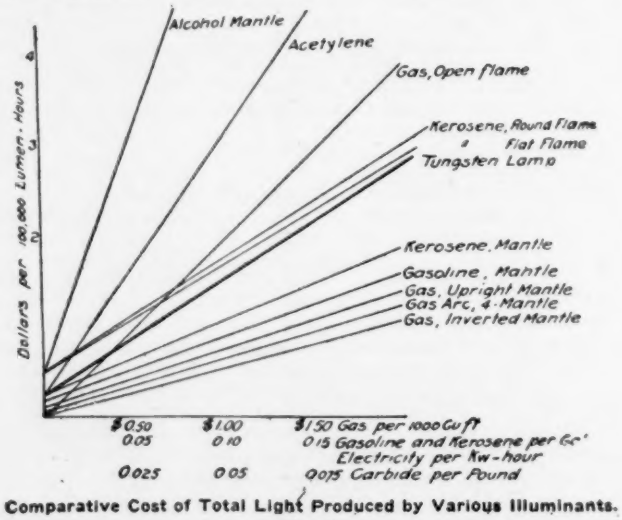
ments as a rule concede this, or perhaps, more strictly speaking, ignored it, and have been built up on the points of convenience, ornamental effect, distance control, cleanliness, etc. All of these things may be granted to electric lighting without in any manner making one the less a good gas man. Gas sales are built up on the very real merits of gas as transformed into a high grade illuminant, by means of the modern mantle burners, and not by belittling a worthy competitor. The successful gas manager, or manufacturer of gas lighting apparatus, is not blind to the excellence of electric light; it is not necessary for him to be a reactionary in thought or deed. He sees the growth of electrical service of all kinds without anxiety for the future of his own business, because all of that has been passed through and the inherent strength of his position has been proven by the ever increasing sales of his own product. He who begrudges a corresponding advance of a kindred business, through the widening market of a more developed field, is too narrow to have a place in present day commercial work. So it is that we gas men can calmly and dispassionately discuss comparative figures in open session without fear of competitive eavesdropping, or favor of that which our opponents choose to characterize our weaknesses.

It is only recently that electric light has made its claim on the basis of direct lower cost to the user. As just said, it has been customary to dwell upon the accessory benefits, so called, in making the offering attractive to the consumer of close figuring proclivities. At the last annual meeting of the National Electric Light Association, and again at the June meeting of the New York Section of the Illuminating Engineering Society, the claim was made that electric lighting is cheaper than gas lighting. In both instances the electric figures were based on laboratory tests and the gas figures on installation observation. Proof was not submitted at either time that electric working tests show the efficiency claimed and the published records are all to the contrary.

The latest improved type of inverted arc lamp gives a mean spherical candle power of 24.1 per cubic foot of gas per hour, and a mean lower hemispherical candle power of 35.7 without any reflecting shade. Repeated tests in different places under varying conditions average 21 spherical candles or better. Compared with the electrical showing of 1 horizontal candle power per 1¼ watts of the famed tungsten, I have been accustomed to regard this lighting business of ours as a husky proposition, entirely able to look out for itself in the give-and-take combat of the 20th century ways. It is not the part of wisdom, though, to underrate a competitor and, therefore, to ascertain if possible, whether the strength of the opposition had really grown beyond my knowledge so much as to put our cause on the back number list, a careful study was planned. This led directly to the columns of the electrical press, which naturally would reflect the thoughts and achievements of those in the forefront of that industrial army. It was very quickly noted that the commercial selling enthusiasm largely emanated from the front pages of these journals. It is unnecessary to cull from this department. If you ever heard a good electric solicitor line-up a prospect you will have the main points of the argument; everything is assumed "best on earth," "only up-to-date system," and so on. Back, however, on the technical pages, where the results of research work and scientific investigations are published, we find a refreshing resemblance to those friendly parallel columns of earlier days, when electricity did not deign to qualify beneath the ranks of a luxury.

The *Electrical World*, of April 20th, 1911, publishes a scholarly article by Isador Ladoff, from which we take the following comparative costs of the more common commercial illuminants. The same figures, but calculated in Hefner candles and German money, were given by A. Linker in a German electrical paper a year or so ago.

At a meeting of the Chicago Section of the Illuminating Engineering Society, held December 15, Prof. J. M. Bryant and Mr. H. G. Hake, of the School of Electrical Engineering, University of Illinois, presented a paper on "Comparative Costs of Producing Light with Different Illuminants" embodying the results of investigation and research work carried on at the University Experiment Station at Urbana, Ills. Their results were shown graphically by the chart reproduced herewith:



Comparative Cost of Total Light Produced by Various Illuminants.
Fig. 1.

The London "Electrician," October 22d, 1909, quoting from L. Gaster's Cantor lectures on modern method of artificial illumination, says:

"He also gives the following comparison of the cost of gas lighting and electric lighting on the basis of figures of Blondel, assuming gas costs as 0.2 franc (4 cents) per cubic meter ($1.13 per 1,000 cubic feet), electricity at 0.7 franc (14 cents) per kw.-hour." (See table at top of page 61.)

The figures may easily be brought into our terms by taking the values, 1 franc = 20 cents; 28 liters = 1 cubic foot; but this is not at all necessary in getting at relative values. Attention might be called to the fact that decreased spherical candle power in this instance is shown for the inverted mantle, another exhibit that all investigators do not investigate alike.

L. Bloch, of Berlin, Germany, in a communication to the *Electrical World*, has given these:

Practical Values of Consumption with Most Usual Lighting Methods.

Sources.	Consumption per Square Foot per Foot Candle, Illumination, Street watts.	Illumination, Interior Watts.
Carbon filament lamps	0.9 –1.3	0.55–1.3
Nernst and tantalum lamps	0.4 –0.65	0.25–0.65
Metallic filament lamps	0.28–0.45	0.17–0.45
Ordinary direct-current flaming arc lamps	0.17–0.28	0.17–0.33
Direct-current flaming arc lamps	0.55–0.13	.....
	Cu. Ft. per Hr.	Cu. Ft. per Hr.
Vertical incandescent gas lamps	0.016–0.024	0.012–0.024
Vertical incandescent pressure gas lamps	0.012–0.024	0.008–0.016
Inverted incandescent gas lamps	0.010–0.018	0.008–0.016

TABLE I.—*Comparative Costs of Light from Various Sources.*—(Ladoff.)

Source of Light.	Consumption for 100 International Candle Power Hours.	Candle Power Measured.	Price of Fuel or Energy, Cents.	Cost of 1,000 Cents.
Paraffine candle	1.87 pounds.	horizontal.	18 per pound.	32.0
Petroleum	0.73 pound.	spherical.	3.2 per pound.	2.33
Petroleum incandescent lamp	0.22 pound.	spherical.	3.2 per pound.	0.70
Alcohol incandescent lamp	0.1 gallon.	spherical.	19 per gallon.	1.90
Gas (ordinary burner)	67.0 cubic feet.	spherical.	113 per 1,000.	7.55
Gas, incandescent lamp	7.8 cubic feet.	spherical.	113 per 1,000.	0.88
Inverted gas incandescent lamp	6.4 cubic feet.	spherical.	113 per 1,000.	0.72
Acetylene	4.6 cubic feet.	spherical.	700 per 1,000.	3.2
Electric carbon filament lamp	350 watt hrs.	horizontal.	12.5 per kw.-hr.	4.4
Nernst lamp	165 watt hrs.	horizontal.	12.5 per kw.-hr.	1.9
Tantalum lamp	165 watt hrs.	horizontal.	12.5 per kw.-hr.	1.9
Osram, tungsten, zirconium, sirius colloid lamps (100 volts)	110 watt hrs.	horizontal.	12.5 per kw.-hr.	1.4
Electric arc lamp, without globe	130 watt hrs.	hemispherical.	12.5 per kw.-hr.	1.6
Electric arc lamp, with globe	190 watt hrs.	hemispherical.	12.5 per kw.-hr.	2.4
Inclosed arc lamp	169 watt hrs.	hemispherical.	12.5 per kw.-hr.	2.1

Comparative Costs.—(Blondel.)

	Incandescent Gas.		Incandescent Electric Lamp.			
			Carbon 32-C. P. for 300 Hrs.		Tungsten 32-C. P. for 1,000 Hrs.	
	Upright Liters,	Inverted Liter.	110-Volt Watts.	220-Volt Watts.	110-Volt Watts.	220-Volt Watts.
Hourly consumption in watt-hours or liters	80	80	100	100	35	45
	Franc.	Franc.	Franc.	Franc.	Franc.	Franc.
Corresponding cost in francs	0.016	0.016	0.07	0.084	0.0245	0.0315
Cost of renewals per hour	0.0025	0.004	0.0017	0.003	0.0037	0.0062
Total cost of lighting per hour	0.0185	0.020	0.072	0.087	0.028	0.038
Mean spherical candle power	55	50	28	28	28	28
Cost per mean spherical candle power per hour	0.00032	0.00040	0.00258	0.0031	0.001	0.00136

The tables above have been taken fairly at random, and simply with the wish to select the results of investigators having no direct interest in any of the lamps reported on. Most any one could find as many more in a short search of the lighting press. There is nothing particularly new about them, and their real significance lies in the contrast between the lower cost of gas unanimously admitted by the disinterested ones, and the directly opposing claims of those engaged in selling electricity who are liberally quoted elsewhere in the same journals.

Exceptions to the tabulated figures are taken as one would naturally suppose, but in practically all of the cases noted in connection with the particular reports under observation a very close relation between the critics and the great electrical firms may be traced. As the grounds for dissent come up later, in a somewhat different connection, they will not be reviewed at this time.

The electric man has never been backward about rating his product in the manner best calculated to show its best figures. It so happens just now that the mazda lamp unshaded throws nearly ½ its light above the horizontal, therefore, flux of light or total lumens is pronounced the proper measurement. Compare this with an editorial comment in the *Electrical World*, February 24, 1906, praising the Nernst lamp on account of its great mean, lower, hemispherical candle power:

"That the competition of this type of gas burner (mantle type) with the electric illuminant is severe in the majority of places cannot be denied, and it has perhaps been most keenly felt where the gas 'arc' has come into direct competition with alternating current arcs. As is well known, both of these sources are deficient with respect to the proportions of total light thrown downward at angles below 60° from the vertical." Explanation of the great advantage of a Nernst lamp's increased lower hemispherical candle power then followed, and in conclusion, a 3-glower lamp was held to be able to replace a 4-burner gas arc. At the usual rating of 1 glower = 3-16 candle carbon lamps, the 4-mantle arc was calculated to be displaced by 144 Nernst candles, something that never quite worked out in practice.

The Nernst lamp did not secure the firm hold anticipated, and upright gas arcs are being retired for a more effective type, but the line of reasoning employed to prove the superiority of the electric Nernst over the upright lamp, now has switched to the advantage of the gas man with his inverted lamp, throwing the strongest light in the lower hemispherical zone, while the mazda, by the admission of its makers throws, half its light above the horizontal where "ordinarily it is of little use."[1]

It will be urged that properly designed reflectors redirect the tungsten rays so as to minimize the loss by its natural upward tendency, though is was previously overlooked that the same method most effectively corrected a like tendency of the upright mantle's light. We, however, are not obliged to give this much consideration, as the inverted mantle is the one we are now principally concerned with, and this has an ideal natural light curve. It is a very positive advantage, as will be shown later, to be free from reflector shades, and it is well to get the idea firmly impressed that, with the inverted mantle, we relieve ourselves of a burden ever present with the metallic filament lamp.

The carbon bulbs, the various arcs and the Nernst glowers having fallen short of bringing about the promised domination of the lighting situation, it is time to expect an attack of some sort, and for a broad side volley we have found nothing else in the published records that compares with the "Report of the Committee on Competitive Illuminants" presented to the last National Electric Light Association convention.

It is only fair to state that this report has been severely criticised as exaggerated and misleading, but despite that it stands as the official primer from which electric solicitors are to draw their facts and deduce the argument necessary in their work.

It starts out, "Gas, which up to a few years ago was the leading illuminant, has been largely superseded by electric light." With some magnanimity it is conceded that mantle gas lights may be considered competitors of high efficiency electric lamps. The inverted burner is allowed "the advantage that it directs more of the light where it is needed." The explanation of the relative efficiency figures in the table, given as "makers' ratings," would be correct if the apostrophe was moved a space to the left to make the singular number. It is not accepted generally that only the light directly concentrated below the source is useful.

The gas arc or cluster lamp comes in for several raps, but especially because gas men concede that they require regular skilled attention.

Alleged vitiation of the air and bad color of mantles of course are referred to; no electric talk is ever complete without this. At this place some one forget himself and started to mention fire risk, but evidently realized that this was a dangerous ground and dropped it without enlargement or the safer plan of an erasure.

Difficulties of adjustment, due to fluctuating pressure and changing specific gravity of gas, are held to be regular trouble makers, and lest bettter gas engineering correct this, nature itself is called to task for altering atmospheric conditions and again upsetting the painstaking work of the lamp trimmer. The conclusion is, therefore, forced upon the committee that, with all these adverse conditions, no gas lamp with proper self-respect can ever be expected to live up to more than 60 to 75 per cent. of its initial laboratory rating.

It finds "that a tungsten lamp having two-thirds the mean spherical candle power shown by an incandescent gas lamp in a photometric test, will, under service conditions, produce an equivalent or greater illumination than the gas lamp, provided that the distribution of light from the two units is equally favorable."

Pilot flames are held to add 30 per cent. to annual consumption of gas on the assumption of one pilot for each mantle. Under the operating costs the gas charges appear to be right for the lamps taken, but, if the upkeep in charges in mantles, glassware and labor are correct, there is something wrong in the maintenance. I can refer to thousands of lamps where the cost is but a fraction of the figures given. After all this, to the committee's mind, it becomes "evident that, at the usual rates for electricity and gas, the total cost of operation with mazda and tungsten lamps, which is also true of the Nernst, Cooper-Hewitt and Moore light, is in reality less than for inverted gas lamps and is not more than two-thirds the cost with upright units." Concluding, the gas data is:

Comparative Costs.—(N. E. L. A.)

	Total Annual Operating Cost, 1,000 Hours' Operation. Gas at $1 per 1,000 Cubic Feet.			Mazda-Holophane, Capacity for Equal or Greater Illumination, Electricity at 10 Cents per K.W-Hr.	
Gas Unit.	Rental Basis.	Maintenance Contract Basis.	Maintenance by Consumer.	Unit (Watts).	Annual Operating Cost.
Reflex holophane	....	$7.96	$7.70	1-60	$7.91
Reflex diffusing globe.	....	7.96	7.70	½x100	6.19
4-mantle inverted arc	$29.62	28.93	26.28	3-60	23.72
5-mantle inverted arc	33.37	32.83	30.68	1-250	29.78
Welsbach, Jr	....	....	5.50	25	3.91
Standard Welsbach	....	....	9.36	½x100	6.19
2-mantle upright arc	25.62	24.27	21.17	1-100	12.38
4-mantle upright arc	36.62	35.29	33.99	3-60	23.72
Open flame	....	....	6.00	½x40	2.77

Now, that we have heard it, let us go back for a few comments. Electricity, instead of superseding gas, has stimulated it; more light is used than ever before, and more gas is used for lighting. This may not be true of those cities where combined utility companies throw the weight of their influence toward electric lighting, but where real competition exists gas lighting flourishes. It does not show with the spectacular effects of electric light, but it does show on the books from which earnings are computed. No one has more exact knowledge of this than you, gentlemen, of the National Commercial Gas Association.

I will pass by the criticism of single mantle burners, because that style of lamp has always had its loyal champions, and undoubtedly will continue to take care of itself; furthermore, it it is somewhat out

1. Bulletin National Electric Lamp Association.

of my own line of work.[1] It may, however, be well to mention the fact that central station companies are again seriously considering a return to flat rates for residence lighting. Tungsten lamps, on account of their high renewal costs, will be relied on to keep consumers from wasting current through fear of wearing out their lamps. As it is well known that many people will pay a higher total yearly amount in equal installments each month than they will where bills increase with the shortening days, it will be advisable for gas men to keep an eye on this revival of an old-time electrical proposition.

On the subject of regular inspection and maintenance of gas lamps, we plead absolutely guilty to the charges made in the electrical committee's report. It is an essential feature of all good gas lighting service. More readily and cheaply done with good gas arc lamps than with scattering single burners, but still a most necessary thing to be looked after wherever mantle burners are used; and that is everywhere.

Linked inseparably with maintenance comes the question of deterioration, on which our competing brothers hang all their hopes and proofs of lower operating costs. Whatever merit the arguments adduced may have, and they are not without foundation, is a direct arraignment not of gas mantle lamps but of gas company management. The manufacturers have produced burners and mantles which will not depreciate 30 or 40 per cent., as asserted, if given the attention that their claims as revenue earners entitle them to. In gas arc lighting (and its field is the one most vigorously contested) lamps will operate at 80 to 90 per cent. of laboratory efficiency all the time at a maintenance expense under 25 cents per month, which amount the user will cheerfully pay himself; but effective maintenance is not secured with cheap mantles and cheap men. The greatest strength and shrewdest business judgment of the electric light business of this country to day are its support of the electric lamp makers, who, "Trust or no Trust," are consistently living up to the idea of not how cheap but how good incandescent lamps can be made.

If your electric opponent can make the statement (and get away with it) that the gas lamps in his district never operate at better than two-thirds of rated laboratory value then the thing to be discussed in Association meetings is not comparative efficiency of gas and electric lamps, but of gas and electric management.

Let us see, though, if gas lamps are the only ones subject to loss of light in operation, and if lamps' inspection with maintenance is a gas man's burden solely. Turning to the columns of that high authority the *Electrical World* we find ample argument to the contrary. For instance:

"*Tungsten Lamps in Dirty Places.*—It has frequently been urged in favor of tungsten lamps, when they have displaced arc lamps, that they require less attention in the shape of trimming. While it is of course true that they require less attention, and that their efficiency is considerably higher than the common, inclosed carbon arcs in use at the time the tungsten lamp came into the field, it may neverthless be equally true that the fact that the arc lamp requires frequent trimming and cleaning is a positive gain to the purchaser of light rather than a detriment. In many establishments lamps are likely to be absolutely neglected as far as cleaning is concerned, unless there is trimming required. The tungsten lamp makes a fine showing as compared to the old arc lamps when it is first installed and cleaned, but we have seen many installations where dirt has been allowed to collect on tungsten lamps, so that most of the supposed advantages in efficiency have been wiped out. However, it is a mistake to suppose that when an arc lamp is trimmed its globe is necessarily cleaned. Attention which is ordinarily given to trimming and cleaning of arc lamps is insufficient to obtain the best results. Not a few arc-lamp installations which are supposed to be in good shape show remarkably poor results when actually tested, simply because of lack of adjustment and cleaning."

"*Cleaning Tungsten Lamps and Reflectors.*—It is well known among central-station companies that it is difficult to get consumers to clean their lamps and reflectors frequently enough to get the best service. Certain difficulties have developed in connection with the cleaning of tungsten lamps and glassware which were not present with carbon lamps and are worthy of serious consideration. The consumer who uses tungsten lamps has usually been impressed, either by experience or by the injunction of others, with the idea that the tungsten lamp is very fragile and should not be handled. He takes instructions literally and never cleans the lamps or reflectors for fear of breaking them. The result is that some installations which were very creditable in the early days of tungsten lighting have now depreciated to a point where they are anything but creditable. Besides the fear of breaking the tungsten lamps another thing deters many users from cleaning reflectors thoroughly. The majority of shade holders which have been installed with reflectors on tungsten lamps have probably been of a new patented type which, although excellent in mechanical design, is unfamiliar to the average user. In other words, the user does not know how to remove the reflectors as he did in case of the old standard line of shade holders with thumb screws for attaching the shade. This tends to prevent users from taking down glassware for cleaning.

"Some central-station companies have gone so far as to do a certain amount of careful cleaning of tungsten lamps and reflectors for customers. However, this cannot be considered a permanent solution of the question, because it would be prohibitive in cost if carried out on too large a scale. The real solution lies in a campaign of education among consumers to show them how to clean lamps and glassware with least danger of breaking. Probably the best plan is to teach them to clean lamps as far as possible while they are burning. This also applies to reflectors or glassware. It is not possible to give a piece of glassware as thorough a cleaning when in place over a lamp as if it were taken down and put in soapsuds, but it is possible to get off so much of the dirt with the aid of a damp cloth and a stiff-bristle brush (the latter for cleaning cracks or prisms) that a thorough cleaning can be put off until such time as the lamp burns out, when the reflector can be taken down and thoroughly washed."

"*Handling and Cleaning Tungsten Lamps.*—Tungsten lamps and their peculiarities are so well understood now by the general public in many towns that there is no need of any special precautions as to their handling and cleaning on the part of the central station company which sells or encourages them. However, some companies have found it advisable to establish a system of cleaning regularly some of the principal installations in the town where there is considerable competition with natural gas and other cheap illuminants. We understand, also, that in some cities some concerns, independently of the central station organization, have gone into the business of maintaining consumers' installations, furnishing lamp renewals and the cleaning of lamps and reflectors. A good tungsten lamp installation, well designed when new, is tolerably sure to give the consumer good satisfaction. In fact, he is very much pleased with it, as a rule. This is the secret of its success in displacing gas and gasoline installations. However, there is sure to be a certain number of consumers who do not think it necessary to give their lamp installations a thought after they are installed. The result is they accumulate dirt until the consumers begin to get dissatisfied. For this the central station company is not to blame, but, as a matter of fact, the company is always considered responsible for the poor light. There are probably but few, if any, central stations which make it a regular practice of cleaning tungsten installations in stores. Nevertheless, there are many central station managers in small towns who, as a safety precaution, will send a man out to clean a consumer's installation which is notably dirty, or, at least, will take the glassware down for the consumer to clean when it is noticed that it needs it badly. This is to keep the consumer satisfied and to have the installation a good advertisement for the company's service.

"It is seldom that a comsumer who has not enterprise enough to keep the lamps and reflectors properly cleaned will have a job of cleaning done properly when he attempts it. Whenever tungsten lamps are cleaned in the socket they should always be cleaned while burning, in order to avoid the danger of breaking. However, there are times when it is advisable to take down the lamp and the reflector and give them a thorough cleaning with water. Of course, reflectors of the mirror type, as in use for indirect lighting, should not be absolutely submerged in water, but the cleaning of the glass surface with a damp cloth is necessary in most cities, where there is an accumulation from smoke and soot which cannot be removed with a dry cloth. This accumulation of smoke will depend very much on the surface of the glass, some kinds accumulating much more than others. Fire-glazed glass usually is much easier to clean than plate or pressed glass. Now that the fragility of the tungsten lamp is better understood than formerly, there is not the danger in letting consumers clean their own installations that there once was when the lamp was new and when it was being tried under the gaze of very critical eyes."—*Electrical World.*

Not only have the journals been busily engaged in pointing out the bad effect of dirt on globes and reflectors but exact figures are adduced from practical working tests. Mr. A. L. Eustice presented a paper before the Chicago Section, Illuminating Engineering Society, the subject being "Lamp Efficiencies or the Efficiency of the System: Which?" This paper took up the results of some of a large number of tests made by Mr. Eustice on the loss of light due to dirt on globes and reflectors. The results given included one laboratory test on a 60-watt tungsten lamp and clear prismatic bowl reflector, 13 tests on actual installations of Nernst lamps before and after cleaning, and two tests on an installation of 4-ampere arc lamps.

The test on the tungsten lamp and reflector, which was made after they had been hanging for one year in the Nernst factory laboratory, so that a large amount of dirt had collected. show 35 per cent. loss in lower hemispherical candle power. Cleaning the reflector by wiping and dusting reduced this to 19 per cent. The lamp and reflector were scrubbed in soap and water. The results of measurements then taken were made the basis for percentage losses given before.

The 5 Nernst lamp installations tested showed losses ranging from 1.2 per cent. to 20.4 per cent. In some of these cases the loss was par-

1. I have since had opportunity to read Mr. R. F. Pierce's able "Notes on Comparison of Illuminants," in October issue of "Illuminating Engineering;" and as it refers more particularly to smaller units, I commend it to your attention.

tially due to depreciation of the lamp by the falling off in candle power of the glower and the blackening of the reflecting surface above the glower. The lamps when tested dirty were in ordinary maintenance condition. The arc lamp installation showed a loss of 20 per cent., largely because of the dirty condition of the inner globes. In presenting the figures, Mr. Eustice called special attention to the danger of taking laboratory figures as representing commercial conditions of actual installations.

In line with all this, we find compliments bestowed on an enterprising company which believes that regular maintenance is a part of good electric service; the "man behind the gun" in this case being a mighty good gas man, Mr. Robert M. Searle, and the Company, the Rochester (N. Y.) Railway and Light Company. Quoting again from the *Electrical World* in this connection:

"In order that installations do not suffer from careless treatment, and also that the best results may be obtained, an employee of the Company inspects each installation regularly, renewing all burned-out and blackened lamps, and also washing and cleansing the shades at regular intervals. In this way the consumer gets the full lighting efficiency and is impressed with the painstaking care that the Company is showing toward giving him the most satisfactory service possible."

A gas manager friend of mine recently told of being in a barber shop and hearing the tungsten-holophane lamps over the chairs severely criticized as "No good any more." Wishing to perform a friendly office he called attention to the accumulated dust on the reflector top and suggested washing, thinking that the remaining portion of the lighting equipment, consisting of single mantle inverted lamps with prismatic reflectors, would also benefit in the general clean-up. Somewhat to his disgust, on his next visit to the shop, the electrics were much improved but the gas lamps were untouched. However, vigorous language on his part brought results, and the entire illumination of that place is now greatly bettered.

I have gone into this matter at considerable length because the basis of all claims for lower cost of electric lighting, as made to-day, rests on the premises that electric lamps, particularly the metallic filament variety, operate at practically initial efficiency, and that gas lamps only give two-thirds the efficiency under average working conditions, about the most high handed brand of reasoning, in view of the facts shown, that one can well imagine. Getting down, now, to gas operating results, I will leave the single mantle unit to those more closely in touch with that branch of gas lighting.

In upright gas arcs the 2-mantle lamp may be passed by as there is not 1 of them in use to 100 four-mantle. The gas consumption of the 4-mantle upright lamp never should exceed 20 feet per hour, when adjusted for most effective service, and despite the stories of our electrical adversaries the adjustment is a very simple thing. Following the figures taken of 1,000 lighting hours per year we get a consumption of 20,000 feet of gas used during burning hours; adding pilot consumption, at 0.3 feet per hour, for remaining 7,760 hours we have 2,328 feet; total for the year, 23,280 feet. Lamps are seldom placed at a rental maintenance charge of over 50 cents per month; this, with gas at $1, makes yearly cost to user $28.33 at a maximum. Many lamps operate on less than 18 feet per hour, and are rented at 25 cents per month; but, assuming 18 feet rate, we have an annual cost of $23.33, or less than 3-60 watt lamps it has pleased the committee to call equal to a 4-mantle, upright gas arc.

Several years' experience with 3-mantle inverted arcs has conclusively proved that they will acceptably replace 4-mantle arcs. The total lighting power has not been quite equal to the upright arc, but the better distribution has given a more acceptable visual effect on a working plane. There is now, however, on the market a more efficient 3-mantle inverted lamp, with actually increased candle power over the 4-mantle upright, which will again greatly strengthen a gas company's lighting business. The average consumption of a 3-mantle inverted arc is 12 cubic feet per hour; taking the pilot consumption of 0.3 feet per hour and rental of 50 cents per month, we have as annual cost $20.33. Maintenance cost figures secured several months ago from some 50 representative gas companies, showed that this style of lamp may be rented to the user at a profit for 25 cents per month, which would reduce cost to consumer to $17.33 per year.

The 4 mantle inverted arc, burning 15 cubic feet per hour, will take 15,000 feet in the 1,000 lighting hours and, adding the pilot consumption, 2,328 feet, we have as annual consumption 17,328 feet, which, at 50 cents monthly rental, total cost is $23.33; or, at 25 cents rental, $20.33. Tabulating these figures for cost comparison with the electric lamps held to be of "equal or greater" illuminating value we get:

Gas Unit.	Total Annual Operating Cost 1,000 Hours, Gas at $1, Rental 25 to 50 Cents per Month.
3-mantle inverted arc	$17.33 to $20.33
4-mantle inverted arc	20.33 to 23.33
4-mantle upright arc	23.33 to 28.33

Electric Unit.	Total Annual Cost 1,000 Hours Use, 10 Cents per Kw.
3-60 watt mazda-holophane	$23.72
1-250 watt mazda-holophaue	29.78

To ascertain to what extent the arbitrary assumption of equality for certain electric units with gas arc lamps, on score of illuminating power, is justified by the facts we will look over the following table of candle power and lumen values.

	Spherical Value.		Lower Hemispherical Value.	
	Candles.	Lumens.	Candles.	Lumens.
3-mantle inverted arc. ...	296	3,720	439	2,760
4- " " "	302	3,800	432	2,717
4- " upright "	240	3,016	357	2,245
Three 60-watt mazda-hol..	40 each	1,494 (total)		750
One 250- " " " ..	175	2,168	....	1,090
One 400- " " " ..	280	3,470	....	....

24.1 spherical candles per cubic foot of gas; 0.66 spherical candles per watt of current; 241 candles for 1 cent (gas cost only); 66 candles for 1 cent (current only).

The above figures have margin enough to permit the pet one third depreciation of the electric advocate on the gas arc, and still leave a very comfortable balance over the 100 per cent. value of the "equal or greater" three 60-watt, or one 250-watt mazda. There really isn't much needed by way of argument. The figures are plain, they have all been taken from recognized authority, and the inverted gas lamps have the further advantage of a natural downward distribution without the use of reflectors, as will be shown by the illuminating curves in the footnotes where they are contrasted with the typical curves of the metallic filament lamps without and with reflectors.

Gas lamp efficiencies are becoming greater, mantle efficiencies are increasing, costs are decreasing, gas is selling at lower rates; supplement this with recognized superiority in color, low intrinsic brilliancy, better diffusion and ideal natural distribution of the modern inverted gas lamp, and the future of gas lighting cannot be considered imperiled.

Gasoline Lighting.—In making comparisons of gasoline lighting efficiency the proper basis is not with gas or electricity at their selling prices, where half the cost is for service. The gasoline lamp user does not get service when he buys his oil and mantles. He simply purchases so much energy which he, by his own efforts, subsequently transforms into light. In other words, he refuses to accept the service of the gas or electric company, preferring rather to devote his own time to that which constitutes so large a portion of the expense account of the public utility companies. If he can perform his work at less cost than the carefully trained and systematized departments of the specializing companies then he has possibly saved something. But no efficiency figures are worthy of attention that include all the elements of cost in one case and but half in the other. Eliminate from gas or electric costs that portion due to service as distinguished from energy and by contrast the supposedly cheap gasoline lighting become the most expensive system one could consider.

The usual argument of the isolated plant user is that the time required for operating the system is negligible, as it is taken when otherwise it would be wasted. As most of these people have considerable spare time, it is hard to convince them that their efforts might be more profitably directed along the lines they are more skilled in, and dollars-and-cents' talk is required.

Granting, for discussion sake, that the usual high power gasoline lamps are equal in lighting value to a gas arc lamp and that the gasoline cost is a third the bill for the gas lamp, let us see how it will figure out in two years, admittedly the average life of the gasoline appliances. A 4-lamp outfit will make a fairly representative installation. This number of 3-mantle inverted arcs, at 50 cents monthly rental, would surely cost $162.64 for two years. On the one-third cost basis, the gasoline bill for same period would be $54.21 plus $50, cost of system equals $104.21, or $58.43 in favor of the oil can; 9½ cents per day saving to pay for time, annoyance, mantles, supplies, etc. The deterioration of a gasoline system is sure and rapid. Starting at high candle power there is usually a

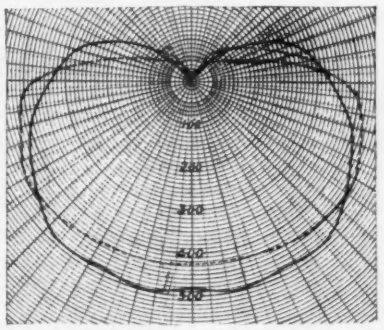


Fig. 2.—Dotted line shows vertical distribution curve of 3-mantle inverted arc, as reported by Electrical Testing Laboratories, New York City. Solid line shows vertical distribution curve of 4-mantle inverted arc, as reported by Illuminating Engineering Laboratories, Welsbach Company.

25 per cent. loss within 4 months, and not uncommonly 50 per cent. in a year. Lack of skilled maintenance is the cause. Sometimes, during a selling campaign, the lamps are looked after by experienced people and held at nearly initial power for several months, but the falling off follows their departure inevitably. To keep a gasoline lighting plant in first-class condition is a task for a good mechanic, and far beyond the ability of the small merchant who uses it. In those cases where a regular inspection system has been tried the extra expense offsets the supposed economy. There is but one way to make the price attractive, and that is to consider the filling of the oil can as the only expense and count all else as contributed freely. The storekeeper must do all work himself, and he doesn't know how to help himself when troubles come. A resourceful gas solicitor calling on one of these men not long ago, after hearing the tale of wonderful cheapness, asked why the merchant didn't put his own well down back of his store and thus get away from the water rental. An apt illustration of this kind will often help the prospect into a frame of mind where he appreciates that the gas company is doing something more for him than simply filling the oil can.

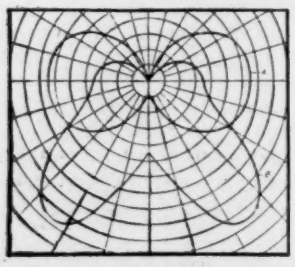


Fig. 3.—Vertical distribution curve of mazda lamp (A) bare; (B) with reflector. From Bulletin 7B, National Electric Lamp Association.

I cannot give photometric readings of gasoline candle-powers, as in the time at my disposal I could not get special tests made, involving as they would the fitting up of entire systems to experiment upon. The makers of this class of apparatus talk easily of 500 and 1,000 candles, and more, but we are probably not harming any one by assuming that 300 spherical candle power is a fair average at inital efficiency. Globes and diffusing shades have a bad effect on the secondary air demanded for complete combustion, and are accordingly omitted as far as possible, leaving a bare mantle of intense brilliancy which is very trying on the eyes.

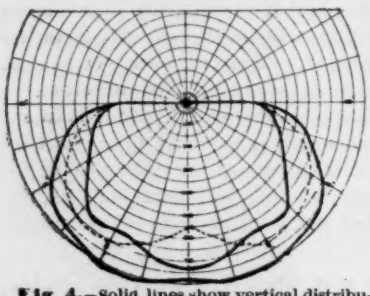


Fig 4.—Solid lines show vertical distribution curves of two different pesigns of 5-mantle inverted outdoor lamps; dotted line, a 500-watt tungsten lamp, all being fitted with enameled steel reflectors.

A common claim is 40 to 50-single unit lamp hours per gallon of gasoline. Mr. Edward Kelley, of Detroit, states that an examination of 200 average installations in that city showed from 14 to 25 lamp hours per gallon. Another investigator reports an average monthly cost of gasoline in 492 units of 74 plants inspected was 64.7 cents.

It is unquestionably conservative to say that the cost per single mantle unit is from ½ to 1 cent per hour for oil alone; averaging the two we get ¾ cent per mantle per hour as a good basis for rapid calculations of gasoline cost. In making the comparison between operating cost for two years of a gasoline outfit as against gas we assumed a lower gasoline cost, and any inaccuracies are unquestionably in favor of the gasoline system.

Several years ago, while investigating the fire and personal injury hazard of gasoline lighting systems, I received over 100 press clippings from a single agency covering a period of but three months. These ran the whole gamut, from reports of property loss up to the most harrowing tales of hurts. burns and loss of life, a cost that cannot be computed in money equivalent.

A study of some directions written out for me once by a gasoline lamp salesman may shed light on the cause of the lamp accidents and likewise the deterioration in service. Your gas works foreman has no such elaborate course of action marked out for him, so imagine all this in the hands and mind of a storekeeper entirely accustomed to details altogether unmechanical:

"Fill the tank with gasoline, clean needle point with brush dipped in gasoline to remove carbon, clean mixing tube. Open air valve then initial heat valve, light match and hold it to generator, use pump until gasoline flows freely and needles get hot. Turn on gas delivery valve, close initial heat valve (if generator flame is confined to generator stop at that), shut off air valve, if apparatus is in good order lamps may now be lighted without trouble. When proper combustion is not obtained an odor of gasoline may be noticed. In such cases examine burner tips for carbonization, gas delivery valve or needle point may be bent or blunted, needle orfice may be out of round, wick in generator charred or it may be water soaked by poor gasoline containing water. Be on the lookout for condensation in pipes in cold places and especially outdoors, also for clogging by paraffine from the oil which may interfere with gas delivery to burner and make a smoky flame and blackened mantle. Do not attempt to use less than two lights at a time from a given generator and be sure to regulate generator for proper number of lights in use." Several of these cautions are repeated probably at necessary points, but I have omitted them. Do you wonder that accidents occur and systems go wrong? And the pay for all this is 9½ cents per day on a four lamp basis, out of which stipend mantles, shades, burner tips and miscellaneous repairs must somehow be settled for! Show all this to your solicitors when you go back home and ask them and yourself how much gasoline competition on your lines may be considered legitimate and how much more may be due to errors of commission and omission on the part of some one either now or at a time past on the company's payroll.

(To be Continued.)

Management & Commercial Methods.

A Notable Installation of Combustion Recorders.—Showing a bank of Simmance-Abady combustion recorders, as installed by the

Semet-Solvay Process Company in its Detroit (Mich.) plant. The recorders are operated in connection with a battery of 12 water tube boilers, of 279-horse power rated capacity each.

Items of Interest
FROM VARIOUS LOCALITIES.

Recent advices by way of Philadelphia are to the effect that the East Pennsylvania Power Company has purchased the plants and franchises of the Easton (Pa.) Gas and Electric Company—which also means control of the plants in Philipsburg, N. J.—which purchase puts the new owners in control of the artificial lighting supply of Easton and Bangor, Pa., and Philipsburg and Dover, N. J. The Company is also the owner of 3 hydroelectric plants in Easton, Pa., and Columbia, N. J. In taking over the Easton Gas and Electric properties the interests thereof will be separated; that is, the gas plant is to be operated separately.

The way in which Mr. H. O. Channon, General Manager of the Quincy (Ills.) Gas, Electric and Heating Company, does business seems eminently satisfactory, in that all branches of its trading have grown with great rapidity. In fact, so great has been the expansion on gas account that he was recently in the market for an 8-foot set of water gas apparatus. The contract for the apparatus has been awarded to the Gas Machinery Company, of Cleveland, O.

The recent annual meeting of the Newport (R. I.) Gas Light Company was likely the best attended meeting ever recorded in the history of this sterling corporation. Perhaps one moving reason for the great share representation was the fact that, for the first time in its history, a Vice-President was to be chosen. President Bull long ago having declared that the duties of the Presidency were becoming so numerous and exacting that it was necessary to afford some measure of relief in respect thereto. Hence, the creation of the office of Vice-President. When the result of the general election was announced it was matter of record that these gentlemen had been selected: President, Henry Bull, Jr.; Vice-President, Andrew K. Quinn; Secretary, Thomas A. Lawton; Treasurer, Andrew K. Quinn. To say that Mr. Quinn's election was hailed with acclaim is to speak the truth; to prophesy that he will be as successful along the new lines of duty as he has been along the old lines (and surely his success with and of the latter was unquestioned, is virtually stating a known quantity.

THE Greenwich (Conn.) *Graphic*, of recent date, is our authority for the following: "The gas and electric light properties of the United Electric Light and Water Company are now in control of the Housatonic Power Company, which possession comes under a leasehold dating back to October, 1911, and to live for 994 years. Contrary to the original report, the United Company is not owned or controlled by the U. G. I. Company, of Philadelphia. It is a new and independent concern having no connection with any other existing or operating company, and is backed by men of wide experience in the gas and electric lighting fields. The project of leasing these properties owes its inception to the late A. M. Young, whose sudden death occurred just at the conclusion of the negotiation. Mr. Young had already perfected the operating organization with a view of making it a model of its kind, progressive and enterprising, broad in its policies, with especial regard to its duties and obligations to the public. Mr. Young's place as President has not yet been filled. The Vice-President is Mr. M. J. Warner; Arthur Perkins (of Hartford) is Secretary; Richard Sutro (of Sutro Brothers & Company, N. Y.) is Treasurer; the Assistant Treasurer is C. L. Campbell (formerly Treasurer of the Dayton, O., Power and Light Company). The General Manager is Alexander J. Campbell, of the New London (Conn.) Gas and Electric Company. The Sutro concern is the financial representative. The properties that pass under control of the United Company are: The gas and electric supply of Norwalk, Naugatuck and Greenwich, Conn., and the electric trading of Waterbury, Watertown, Cheshire, New Britain, Newington, Plainville, Southington, South Norwalk, Wilton, New Canaan and Weston. The main office will be in Waterbury, and one of the first things to be done will be the completion of the gas plant for Greenwich, Conn."

MR. F. W. WHITNEY has resigned from the service of the Omaha (Neb.) Gas Company to go on the road as salesman for the Kimball Automobile Company.

CURRENT news is to the effect that a controlling interest in the Newport News and Old Point Railway and Electric Company, and its 3 subsidiary Companies on the Virginia Peninsula, have been purchased by Wm. J. Payne, of Richmond, Va., for a syndicate of New York bankers and electric railway men, headed by C. L. Allen, of Syracuse, N. Y., and Edward F. Peck, Schenectady. Others associated with them are Messrs. Chas. H. Dickey, E. H. Griswold and John Opper, of Baltimore; and F. M. Duane, of New York.

"I. C. C.," writing from Paducah, Ky., under date of the 9th inst., says: "We have just completed the construction of a new water gas plant, in the shape of one United Gas Improvement Company's 6-foot sets, and a Gas Machinery Company's set, 4 feet 6 inches diameter. Also, a storage holder, 2-lift order, up to retaining 200,000 cubic feet, furnished by the Stacey Company, of Cincinnati. The necessary construction work was done by the Stone & Webster Engineering Corporation, which corporation is the controller of the property.

THE proprietors of the Rutland (Vt.) Railway, Light and Power Company report that the Company's, net earning from operation, in 1911, was $150,801, an increase of $29,159 over the preceding year.

MR. O. M. RAU, Chief Electrician and Superintendent of Lighting, Milwaukee (Wis.) Electric Railway and Light Company, has tendered his resignation, to become effective the 15th prox. His service with the Company dates back to 1902.

MR. MARTIN GILMORE has been elected a member of the Board of Directors of the Nashville (Tenn.) Gas Company. He was also appointed to the Executive Committee of the corporation.

COMMISSIONER THOMPSON, New York Department of Gas, Water and Electricity, has established a "Bureau of Efficiency and Economy" in connection with the department; which was a "consummation devoutly to be wished."

MR. STEPHEN A. REARDON, for a long time in the employment of the New London (Conn.) Gas and Electric Company, has resigned from its service.

THE proprietors of the Cambridge (Mass.) Gas Light Company have petitioned the Board of Gas and Electric Light Commissioners for permission to issue 3,000 shares of capital at the upset price of $200 per share.

THE New Business Department of the East Ohio Gas Company, Cleveland, O., is to be congratulated over the results of the successful campaign just brought to an end in Cleveland, respecting the bringing to the notice of the women of that city the virtues of gas as a cooking agent, and the availibility of such fuel for complete success in what is now known as "Paper Bag Cookery." The campaign was conducted mainly through the columns of the Cleveland *Leader*, in which critical presentations of the paper bag and gas plan were made. These presentations were really in the nature of specially communicated articles (special menus being given) respectively by such well-known culinary artists as Mrs. Helen Armstrong, Mrs. Elizabeth O. Hiller and Mrs. L. Johnston. Hundreds of thousands of No. 2 "Waykuk" cooking bags of paper were furnished on demand by the Cleveland *Leader*, and the advices of the culinary artists, as printed formally in the *Leader*, were then practically ciphered out in their homes by thousands of Cleveland's housewives and cooks. The demonstrations were made in the issues of the *Leader* for Dec. 31, and 7, 14 and 21, Jan., 1912. The experiments made resulted in great good to the business of the East Ohio Gas Company, and if we mistake not, credit for the scheme should be given to Mr. F. R. Hutchinson, the Company's clever New Business Manager,

THE proprietors of the Boston (Mass.) Edison Electric Illuminating Company have notified its customers that, beginning March 1, 1912, the rate for electric current will be reduced to 10 cents per kilowatt hour. The ruling rate is 11 cents.

THE Public Utility Commission, State of New Jersey, has authorized the proprietors of the New Jersey Gas Company to issue first mortgage bonds of the par value of $65,100, and capital stock, amounting at par to $22,100, the proceeds to be used for constructing the plants at Penns Grove and Bridgeport.

MR. R. R. DICKEY will retire from the Presidency of the Dayton (O.) Gas Company, and it is likely that he will be succeeded by Mr. E. W. Hanley, now Vice-President of the corporation. Mr. Dickey will shortly take up the reorganization of the American Board and Box Company, in the affairs of which he has held considerable prominence. Mr. Dickey succeeded his father as President of the Dayton Company in 1907, when his predecessor relinquished office because of illness really traceable to old age. The senior Dickey was in his 91st year at the time of his resignation, and his death occurred September 14, 1908.

THE Directors of the Cranford (N. J.) Gas Light Company have named the following executive management: President, Jno. Kean; Treasurer, J. H. Kean.

RECENT advices from Wilmington, Del., are to the effect that the South Delaware Gas Company, with headquarters and central generating establishment at Seaford, Del., has completed its service lines to Bridgeville and Laurel, and is supplying gas to the residents of the named places. Early this spring the Company will extend its distributing system to the settlements of Federalsburg and Bethel.

MR. JAMES L. RICHARDS, President of the Boston Consolidated Gas Company, has been elected a Director on the Board of the Merchants' National Bank, Boston.

MR. W. C. MCMACKIN, who has served the Hutchinson (Kas.) Gas and Fuel Company as Treasurer since the Company actively started in business several years ago, has tendered his resignation. We regret to add that he proposes returning to Los Angeles, Cal., in the hope that his illness will be ameliorated through the climatic change involved in his going away.

THE proprietors of the Patchogue (Long Isiand, N. Y.) Gas Company have been granted a franchise to extend its mains, westward, to Islip town line at Blue Point. The latter place is on Great South Bay, midway of Patchogue and Babylon, and it has for two score years been famous for the quality of the oysters shipped therefrom.

THE offices, storerooms and workshops of the Peoria (Ills.) Gas and Electric Company, have been removed from the former quarters in the Huget Bank Building to the Frederick Building, the changes in which took quite some time. The Company's new quarters will constitute one of the show business places in the city, and notable in connection with the operation thereof, will be the carrying of plentiful samples lines of fixtures, etc.

The Market for Gas Securities.

The change in quotations for Consolidated gas was to all intent nothing. The shares came in this morning (Friday) at 141 to 141½; but the expression "nothing doing" fairly well describes the morning's attention to the security. The annual meeting is set for the 22d, and while the general belief favors the idea that the meeting will be uneventful, in so far as capitalization references are concerned, we rather look to the session in the light that the annual figures submitted should be sufficient to send the stock up 40 points.

The Brooklyn situation remains unchanged save for the fact that some of its tributaries (notably Richmond Hill, Newtown and Jamaica sections) have been hard set to keep up supply during this fairly "old-fashioned" winter season. Peoples, of Chicago, advanced 3 in the week, and Lacledes were quite a bit starchier than of late. The writer of this, in conversation yesterday with one of the best known financial authorities in the West, was informed that little surprise would be caused in certain circles, if Peoples turned 120 before April 1st.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

JANUARY 22.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	141	141½
Central Union Gas Co. —				
1st 5's, due 1972, J. & J.	3,000,000	1,000	103	105
Detroit Gas Co., 5's	881,000	1,000	75	80
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,500,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	140	141½
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	½	¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	85
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
" Prior Lien 5's	5,612,000	1,000	97	100½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	130	133
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	—	38
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	107¾	108
Preferred	2,500,006	100	114	120
Bonds	10,000,000	1,000	102¾	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	108¾
Massachusetts Gas Companies, of Boston	25,000,000	100	90½	91
Preferred	25,000,000	100	95	95½
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	106	106½
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
acific Gas and Electric Co.	15,500,000	—	5	55
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	106
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,800,000	200	439	440
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting, ———— Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1912. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, time, March 20 and 21, 1912, Auditorium Hotel, Chicago, Ills. Officers: President, C. B. Strohn, Elgin, Ills.; Secretary-Treasurer, F. E. Newberry, Dixon, Ills.

Illuminating Engineering Society.—Annual meeting, Sept. ————1912, ———— Meetings of Sections, monthly. Pres't, A. E. Kennelly, Boston, Mass.; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York, Secretary, Albert J. Marshall, 16 East 40th street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, A. L. Eustice, 105 North Wabash avenue.

Indiana Gas Association.—Annual meeting, Jan., 1913, Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Phimer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, time, May, ——, 1912; Lincoln, Neb. Officers: President, G. W. Clabaugh, Omaha, Neb.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, Sept. 1912. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, time, Sept. ————1912;———— Officers: President, F. W. Blowers, Kalamazoo, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1912; St. Louis, Mo. Officers: President, F. E. Murray, Louisiana, Mo.; Secretary and Treasurer, N. J. Cunningham, Springfield, Mo.

National Commercial Gas Association.—Annual meeting, December, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, May, 1912, Kansas City, Mo.; Officers: President, A. B. Macbeth, Independence, Kas. Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 14th and 15th, 1912 Boston. Officers: President, J. A. Coffin, Gloucester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn, Belmar, N. J.

Ohio Gas Association.—Annual meeting, February 6 and 7, 1912, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary-Treasurer, T. C. Jones, Delaware, O.

Oklahoma Gas, Electric and Railway Association.—President, Noel B. Gascho, Alva Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, Sept. ————1912, ———— Officers: President, W. Baurhyte, Los Angeles, Cal.; Vice-President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, John A. Britton, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Williamsport, Pa., April 8-10, 1912. Officers, President, C. W. Butterworth, Philadelphia, Pa.; Secretary-Treasurer, William H. Merritt Lebanon, Pa.

Society of Gas Lighting.—Annual meeting, Dec., 13, 1912; monthly meeting, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 254 West 39th street, New York city.

Southern Gas Association.—Annual meeting, April 17-19, 1912, Jacksonville, Fla. Officers: President, H. B. Hoyt, Jacksonville, Fla.; Secretary-Treasurer, R. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April 27, 28, 29, 1912; Houston, Tex. Officers: President, J. E. Carroll, Beaumont, Tex.; Secretary, D. G. Fisher, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 15 and 16, 1912, Milwaukee, Wis. Officers: President, H. M. Buck, Waukesha, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.